9/15/07

PHIL, PLEASE FIND ENCLOSED THE INFO ON THE ART 13 AND POWER SUPPLY SCHEMATIC. NOTE THE USE OF THE CHOKE 4-12 H. THE ARTICLE SHOWS A TRANSFORMER WITH CAPACITY OF 375 MA I DONOT THINK THIS IS NECESSARY IF YOU CAN LOCATE A 1200-1250 V CT at 500-600 MA I COULD USE IT.

THE ART 13 INFO IS A COPY OF A COPY THE COPIER DID A GOOD JOB BUT SOME IMAGES ARE A LITTLE DARKER THAN THE ORIGINAL COPY. HOPE THIS IS SOMETHING YOU CAN USE.

YOURS, TRULY

Buddy Herring

THE BOOK IS NOT COMPLETE

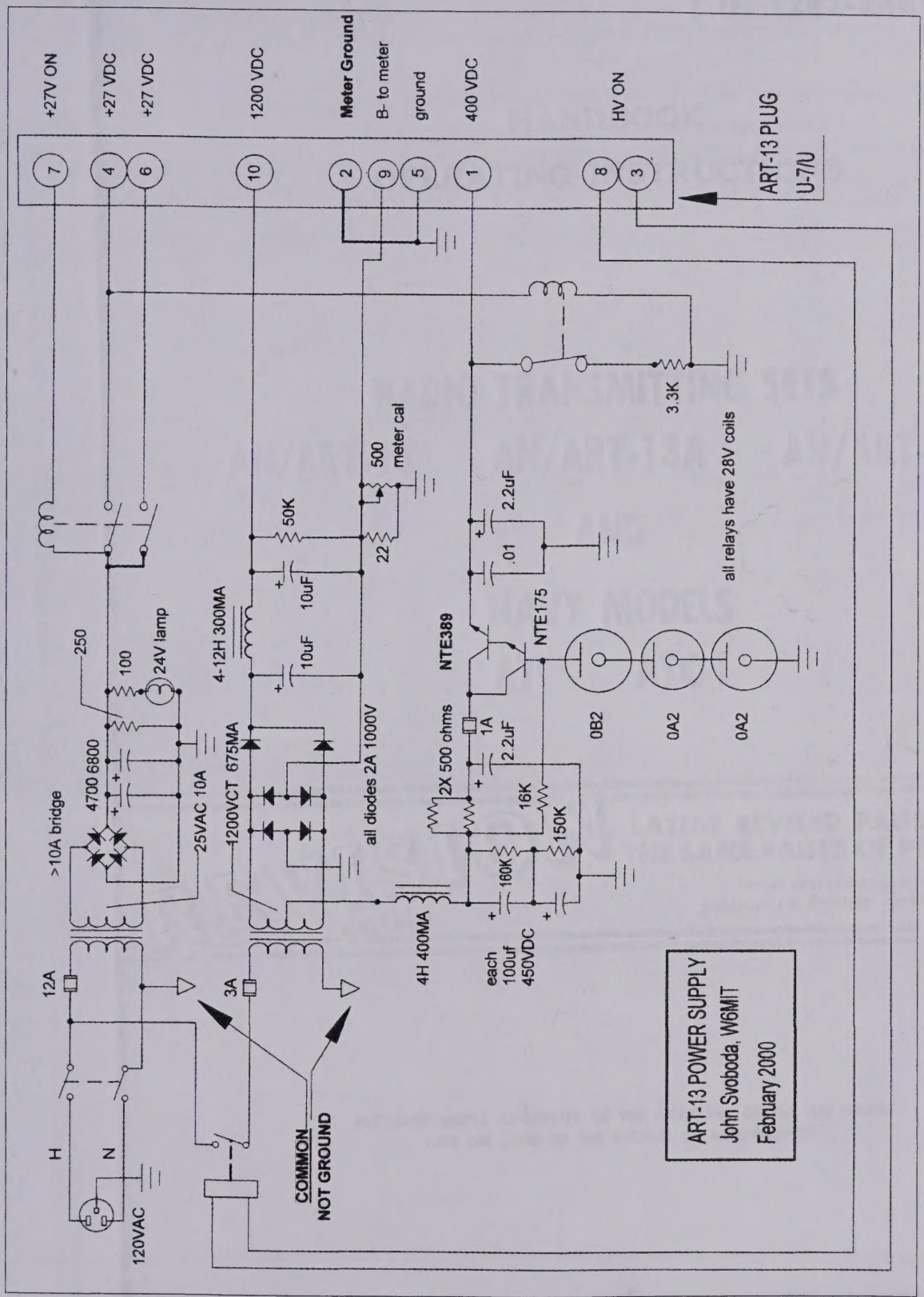

Figure 2: This is the correct schematic that should replace the W6MIT ART-13 power supply schematic on page 28 of December 2003 ER.

15- R. Wheddon

AN 16-30ART13-3

T.O. 12R2-2ART13-1

HANDBOOK

OPERATING INSTRUCTIONS

RADIO TRANSMITTING SETS

AN/ART-13 AN/ART-13A AN/ART-13B

AND

NAVY MODELS

ATC ATC-1

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Destruction of Abandoned Materiel in the Combat Zone

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Burying all debris or disposing of it in streams or other bodies of water, where possible and when time permits.

Procedure:—

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch- and instrument boards.
3. Destroy all controls, switches, relays, connections, and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water-cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving, or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

★

Unsatisfactory Report

For U. S. Army Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Radio model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

For U. S. Navy Personnel:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N.Aer.4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the inspector of Naval Materiel (location to be specified) and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes—no).
7. Remedy used or proposed to prevent recurrence.

For British Personnel:

Form 1022 procedure shall be used when reporting failure of radio equipment.

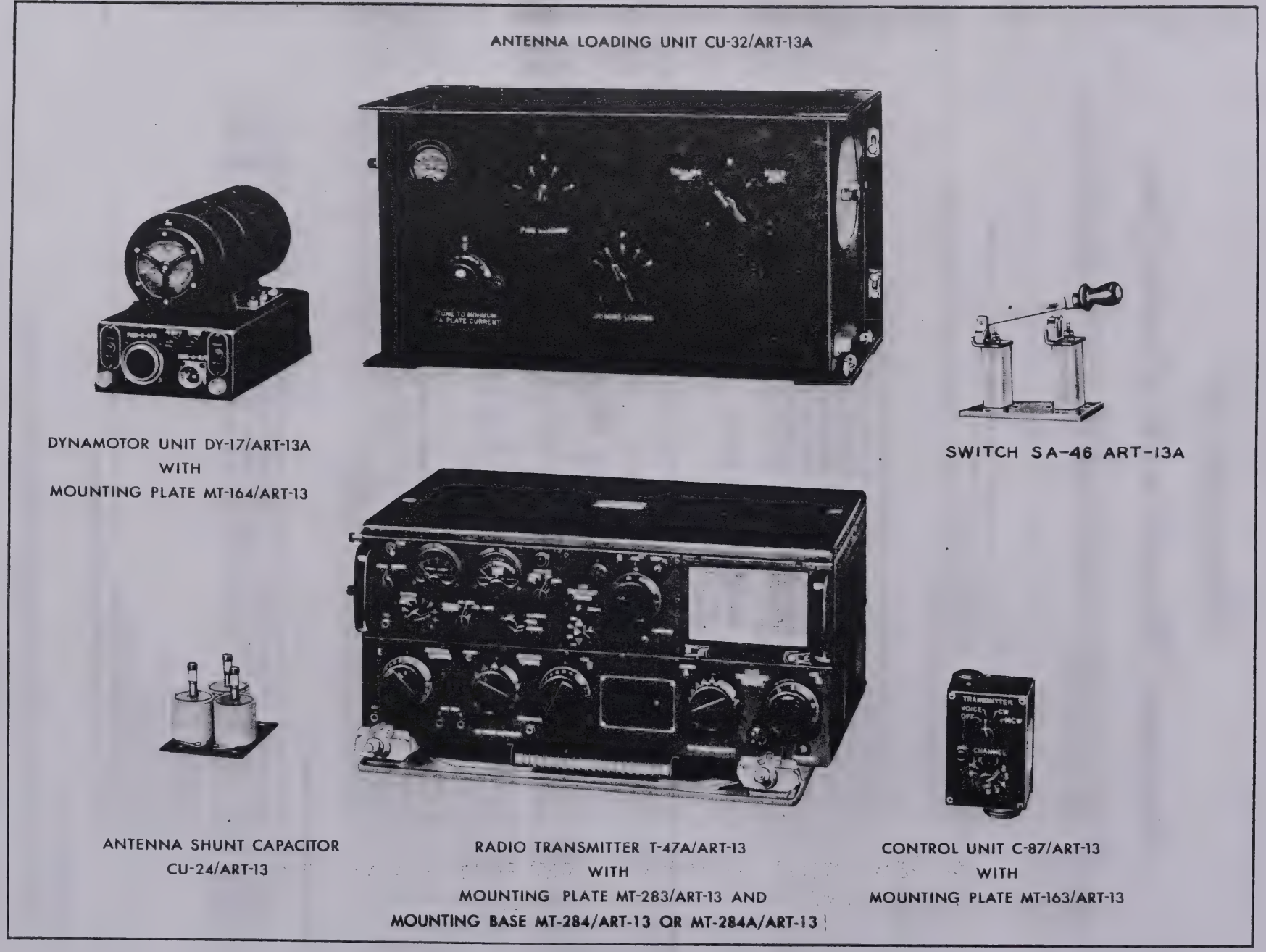


Figure 1-1—Radio Transmitting Set AN/ART-13A—Major Assemblies

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must observe safety regulations. Whenever the dynamotor is running, there is a potential of 1150 volts applied to the plate caps on top of the tubes.

SECTION I
GENERAL DESCRIPTION

1. GENERAL.

a. The contents of this handbook apply to Radio Transmitting Set AN/ART-13A (fig. 1-1); to an earlier model of the same general type of equipment, identified as Radio Transmitting Set AN/ART-13 (also known and employed by the U.S. Navy as Navy Model ATC or ATC-1) shown in figure 1-2; and to the latest model, designated AN/ART-13B, which uses all of the components included with the above two assemblies, excepting their low frequency oscillator units, O-16/ART-13 or O-17/ART-13A. This new model (see fig. 1-2A) includes the CDA-T, 24 frequency Crystal Oscillator Unit, which replaces the original low frequency units. Use of the CDA-T Unit does not interfere with the original VFO functioning of the Transmitter excepting in the frequency range.

b. This equipment includes transmitting components which provide radio communication by voice, modulated continuous wave telegraphy (MCW), or continuous wave telegraphy (CW).

c. Transmission frequencies in the ranges 200 to 1500 kilocycles (when the low frequency oscillator is installed) and 2000 to 18,000 kilocycles can be obtained with this equipment, using a variable frequency oscillator. With the CDA-T Crystal Control Unit installed, replacing the VFO low frequency oscillator unit, 24 crystals provide a frequency range of 300 to 500 kilocycles, and 2,000 to 18,000 kilocycles in addition to 10 frequencies provided by the variable high frequency oscillator.

d. Operation is possible into either fixed or trailing wire antennas. Selection of the desired antenna is accomplished either by means of switches incorporated in low frequency tuning equipment or by means of Switch SA-13/U when low frequency equipment is not used in the installation. This arrangement allows both transmission and reception on the same antenna for all frequencies and is used in Army installations.

e. Using VFO operation, shifting from one transmission frequency to another can be accomplished by the conventional method of "hand positioning" the controls or by using the built-in automatic shifting mechanism known as the "Autotune". Autotune operation (either local or remote) is available for eleven preselected frequencies, one of which may be in the range 200 to 1500 kilocycles and the other ten in the range 2000 to 18,100 kilocycles. For crystal operation, the low frequency VFO unit is removed, and the CDA-T installed in its place. Autotone operation may be used in the same manner as with the VFO, excepting that for each of the first 10 channel positions, two crystal frequencies are available. In the low frequency channel position, four low frequency crystals are available, selected by a switch on the CDA-T Unit.

f. Remote operation of the equipment is possible by means of a remote control unit furnished. The equipment may be turned off or on, the type of emission selected, the channel may be selected and the transmitter keyed or modulated from the remote control unit. Operation from the remote position is possible only when the "LOCAL-REMOTE" switch on the transmitter is in the "REMOTE" position. This switch can be operated only from the transmitter panel. However, the transmitter may be keyed or modulated (according to the type of emission selected at the controlling position) from either position any time that the transmitter is on. The red pilot light indicates which position is in control. It will be lit at the controlling position at all times except when the autotune is cycling.

g. When this equipment is in use at altitudes over 20,000 to 25,000 feet, the power is automatically reduced about one-half to prevent arcing or flashover. Satisfactory operation can then be obtained for altitudes up to 40,000 feet.

Figure 1-2—Radio Transmitting Set AN/ART-13 (Navy Model ATC or ATC-1) Major Assemblies

b. A 28 volt direct current power source is required for operation of the equipment. Voltages as low as 24 volts may be used but reduction in power output and increased time for Autotune operation will result. The dynamotor unit contains a dynamotor machine that supplies the intermediate and high voltage power requirements of the transmitter. The following table shows typical power input requirements for a supply voltage of 28 volts direct current.

Type of Emission Used	*Frequency (mega-cycles)*	*Power Input (Watts)*	
		Full Power	**Reduced Power*
CW	3.0	780	700
CW (Standby)	3.0	560	560
MCW	3.0	925	760
MCW (Standby)	3.0	560	560
VOICE (90% Mod.)	3.0	925	760
VOICE (Standby)	3.0	250	250

*Reduced power input operating at altitudes higher than 20,000 to 25,000 feet results from automatic reduction in high voltage to prevent flashover.

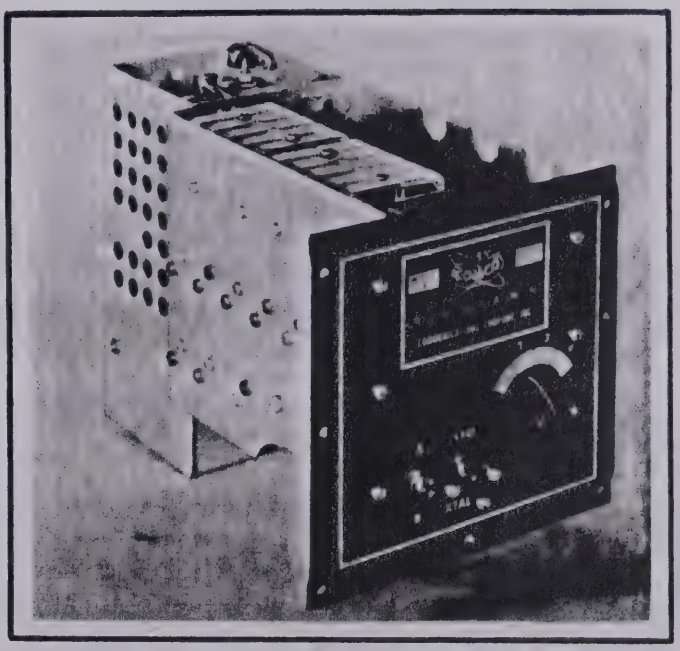


Figure 1-8A—Oscillator CDA-T

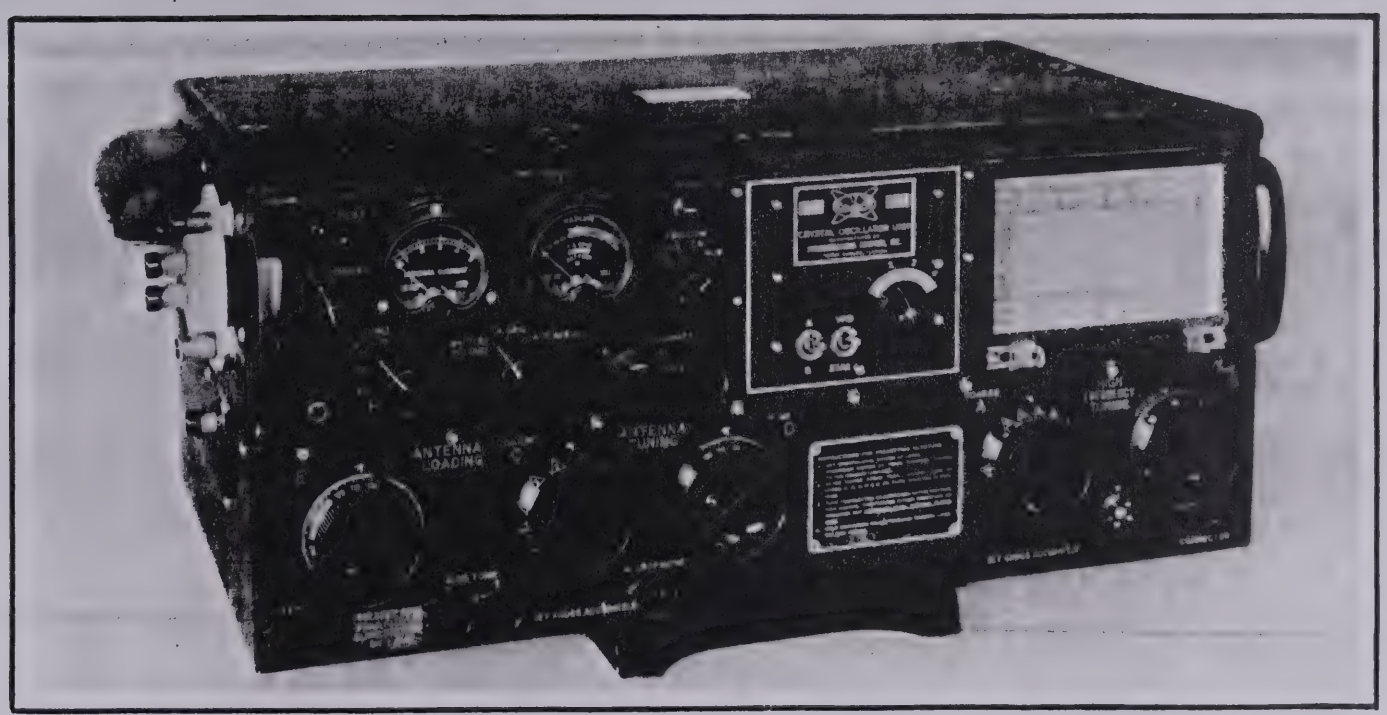


Figure 1-2A—Radio Transmitter T-47A/ART-13 with Oscillator CDA-T Installed

2. EQUIPMENT SUPPLIED.

The table below lists the equipment supplied for Radio Transmitting Set AN/ART-13A. Refer to the table of interchangeability in paragraph 4 of this section when parts of Radio Transmitting Set AN/ART-13 (Navy Model ATC or ATC-1) are supplied.

Quantity per Equipment	*Name of Unit*	*Army Type Designation*	*Overall Dimensions (in inches) Length Height Depth*	*Weight (lbs.)*
1	Radio Transmitter (with Panel MX-128/ART-13 installed, Mounting Plate MT-283/ART-13 attached and Mounting Base MT-284/ART-13 or MT-284A/ART-13 and includes plugs, tubes and crystals)	T-47A/ART-13	23.5 x 11.5 x 14.8	62.5
1	Oscillator (includes tube)	CDA-T	5.4 x 6.4 x 9.7	4.0
1	Mounting Plate (attached to Radio Transmitter T-47A/ART-13)	MT-283/ART-13	20.9 x 1.5 x 13.2	1.6
1	Mounting Base (for Radio Transmitter T-47A/ART-13)	MT-284/ART-13 or MT-284A/ART-13	20.8 x 2.5 x 15.0	3.0
	(Deleted)			
1	Dynamotor Unit (with CQR machine and mounted on Mounting Plate MT-164/ART-13; includes plugs) or Dynamotor Unit (with CG machine and mounted on Mounting Plate MT-164/ART-13; includes plugs)	DY-17/ART-13A DY-17/ART-13A	13.2 x 8.8 x 7.2	28.0
1	Mounting Plate (for Dynamotor Unit DY-17/ART-13A	MT-164/ART-13	11.2 x 1.3 x 7.0	1.1
1	Antenna Loading Unit (mounted on Mounting Base MT-198/ART-13A; includes plugs)	CU-32/ART-13A	25.7 x 13.9 x 13.0	28.3
1	Mounting Base (for Antenna Loading Unit CU-32/ART-13A)	MT-198/ART-13A	22.6 x 2.8 x 11.4	3.2
1	Control Unit (mounted on Mounting Plate MT-163/ART-13; includes plug)	C-87/ART-13	3.6 x 8.0 x 3.2	1.5
1	Mounting Plate (for Control Unit C-87/ART-13)	MT-163/ART-13	5.3 x 3.6 x 0.3	0.11
1	Antenna Shunt Capacitor	CU-24/ART-13	5.0 x 3.9 x 4.2	1.75
1	Switch	SA-46/ART-13A	6.0 x 4.0 x 2.0	0.87
1	Switch	SA-13/U	9.5 x 9.3 x 4.4	2.5
1	Plug (cannon type NK-27-21C $11/16''$)	U-6/U	2.1 x 1.7 x 1.7	0.19
1	Plug (cannon type FK-10-21C $9/16''$)	U-7/U	2.4 x 2.0 x 2.0	0.25
1	Plug (cannon type RNK-27-22C $11/16''$)	U-8/U	2.0 x 1.8 x 1.8	0.25
1	Plug (cannon type RFK-10-24C $9/16''$)	U-9/U	1.9 x 2.6 x 2.1	0.32
1	Plug (cannon type GK-C3-23C $1/2''$)	U-10/U	1.9 x 1.9 x 1.3	0.25
1	Plug (cannon type RWK-C3-22C $7/16''$)	U-11/U	1.9 x 1.1 x 1.1	0.12
1	Plug (cannon type WK-C3-23C $7/16''$)	U-12/U	2.0 x 1.5 x 1.1	0.13
1	Handbook of Operating Instructions for Radio Transmitting Set AN/ART-13, AN/ART-13A and Navy Model ATC and ATC-1		11.0 x 8.5 x 0.5	0.7
			Total weight (cables not included)	140.54

3. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Quantity per Equipment	*Name of Unit*	*Army Type Designation*	*Navy Type Designation*	*Required Characteristics*
1	Microphone (with Cord CD-318 or CD-508) or Microphone	T-17 or T-30 T-34 or T-44		Carbon with 40 ohms internal resistance
1	Key	J-37		
1	Headset	HS-33 or HS-38		300 ohm impedance
1	Antenna Equipment	AN/ARA-4		Fixed 30 to 65 feet long, and/or Trailing to 200 feet long
1	Cables and Wiring			Open wiring (for cable and wiring requirements see figure 5-15)

4. INTERCHANGEABILITY OF RADIO TRANSMITTING SET AN/ART-13A AND SIMILAR EQUIPMENTS.

The following table furnishes mechanical and electrical interchangeability information for Radio Transmitting Set AN/ART-13A, AN/ART-13 and Navy Models ATC and ATC-1. Refer to paragraph 5 of this section for more detailed information.

Name of Unit	*AN Type Designation*	*Navy Type Designation*	*British Ref. Number*	*Mechanically Interchangeable with*	*Electrically Interchangeable with*
Radio Transmitter	T-47/ART-13 (M2- with 8Q-2 CFI Unit; M1— with interlock switch)	—52286	None	T-47A/ART-13 When MT-283/ART-13 is attached	T-47/ART-13
Radio Transmitter	T-47A/ART-13	None	11OD/878	T-47/ART-13 When MT-283/ART-13 is attached	T-47/ART-13 (M2 with 8Q-2 CFI Unit; M1 with interlock switch
Mounting Base	MT-161/ART-13	Part of —52286	None	Nothing	Not applicable
Mounting Plate plus Mounting Base	MT-283/ART-13 plus MT-284/ART-13 or MT-284A/ART-13	None	Part of 110D/878	Bottom cover and two shock Mounts on T-47/ART-13 plus 2 Mounting Bases MT-161/ART-13	Not applicable
Oscillator	0-16/ART-13	Part of — 52286	None	O-17/ART-13A or CDA-T or MX-128/ART-13	O-17/ART-13A or CDA-T except for frequency coverage
Oscillator	0-17/ART-13A	None	110V/21	O-16/ART-13 or CDA-T or MX-128/ART-13	O-16/ART-13 or CDA-T except for frequency coverage
Oscillator	CDA-T	None	None	O-17/ART-13A or O-16/ART-13 or MX-128/ART-13	O-17/ART-13A or O-16/ART-13 except for frequency coverage
Panel	MX-128/ART-13	Part of — 52286	None	O-16/ART-13 or O-17/ART-13A or CDA-T	O-16/ART-13, O-17/ART-13A or CDA-T Transmitter operable in H.F. range without any of the above
Dynamotor Unit	DY-11/ART-13	—23333 or —23333-A plus 21931	None	DY-12/ART-13, DY-12A/ART-13, or DY-17/ART-13A (Height of DY-17/ART-13A is ¾″ greater)	DY-12/ART-13, DY-12A/ART-13 or DY-17/ART-13A (Height of DY-17/ART-13A is ¾″ greater)

Name of Unit	*AN Type Designation*	*Navy Type Designation*	*British Ref. Number*	*Mechanically Interchangeable with*	*Electrically Interchangeable with*
Dynamotor Unit	DY-12/ART-13	−23333 or −23333-A plus −21932	None	DY-11/ART-13, DY-12A/ART-13, or DY-17/ART-13A (Height of DY-17/ART-13A is ¾" greater)	DY-11/ART-13, DY-12A/ART-13, or DY-17/ART-13A (Height of DY-17/ART-13A is ¾" greater)
Dynamotor Unit	DY-12A/ART-13	−23333 or −23333-A plus −21932	None	DY-11/ART-13, DY-12/ART-13, or DY-17/ART-13A (Height of DY-17/ART-13A is ¾" greater)	DY-11/ART-13, DY-12/ART-13, or DY-17/ART-13A (Height of DY-17/ART-13A is ¾" greater)
Dynamotor Unit	DY-17/ART-13A (Height of DY-17/ART-13A is ¾" greater)	None	110K/1448	DY-11/ART-13, DY-12/ART-13, or DY-12A/ART-13	DY-11/ART-13, DY-12/ART-13, or DY-12A/ART-13
Mounting Plate (for dynamotor unit)	MT-164/ART-13	Part of −23333 or −23333-A	Part of 110K/1448	Nothing	Not Applicable
Antenna Loading Unit	CU-32/ART-13A	None	110B/363	Nothing	CU-25/ART-13 plus SA-22/ART-13
Mounting Base (for Antenna Loading Unit CU-32/ART-13A)	MT-198/ART-13A	None	Part of 110B/363	Nothing	Not Applicable
Antenna Loading Coil plus Antenna Switching Unit	CU-25/ART-13	47281	None	Nothing	CU-32/ART-13A
	SA-22/ART-13	None	110F/922	Nothing	
Antenna Loading Coil	CU-26/ART-13	−47282	None	Nothing	Nothing
Mounting Plate (For Antenna Loading Coil CU-26/ART-13)	MT-162/ART-13	Part of −47282	None	Nothing	Not Applicable
Mounting (for Antenna Switching Unit SA-22/ART-13	FT-142	None	Part of 110F/922	FT-142-A	Not Applicable
Antenna Shunt Capacitor	CU-24/ART-13	481628	110B/362	Nothing	Nothing
Control Unit	C-87/ART-13	23330	110L/133	Nothing	Not Applicable
Mounting Plate (for control unit)	MT-163/ART-13	Part of 23330	Part of 110L/133	Nothing	Not Applicable
Switch	SA-46/ART-13A	None	None	Nothing	Nothing
Switch	SA-13/U	None	None	Nothing	Nothing
Plug	U-6/U	None	None	Nothing	Nothing
Plug	U-7/U	None	None	Nothing	Nothing
Plug	U-8/U	None	None	Nothing	Nothing
Plug	U-9/U	None	None	Nothing	Nothing
Plug	U-10/U	None	None	Nothing	Nothing
Plug	U-11/U	None	None	Nothing	Nothing
Plug	U-12/U	None	None	Nothing	Nothing

5. DESCRIPTION OF MAJOR ASSEMBLIES.

The following discussion of the major assemblies of Radio Transmitting Set AN/ART-13A, AN/ART-13 and Navy Models ATC and ATC-1 is to aid in event that a mixed group of assemblies are used for a particular installation. (Refer to pars. 2 and 4, this section.)

a. RADIO TRANSMITTERS.

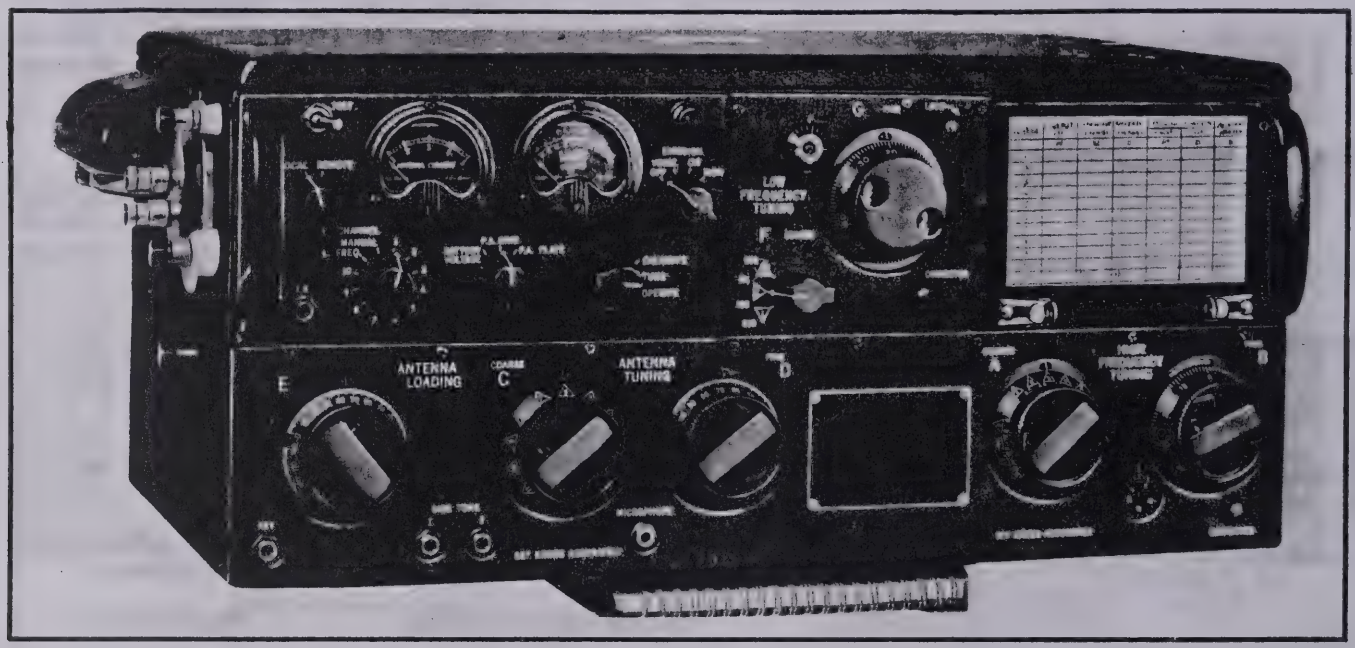


Figure 1-3—Radio Transmitter T-47A/ART-13 with Oscillator 0-17/ART-13A Installed

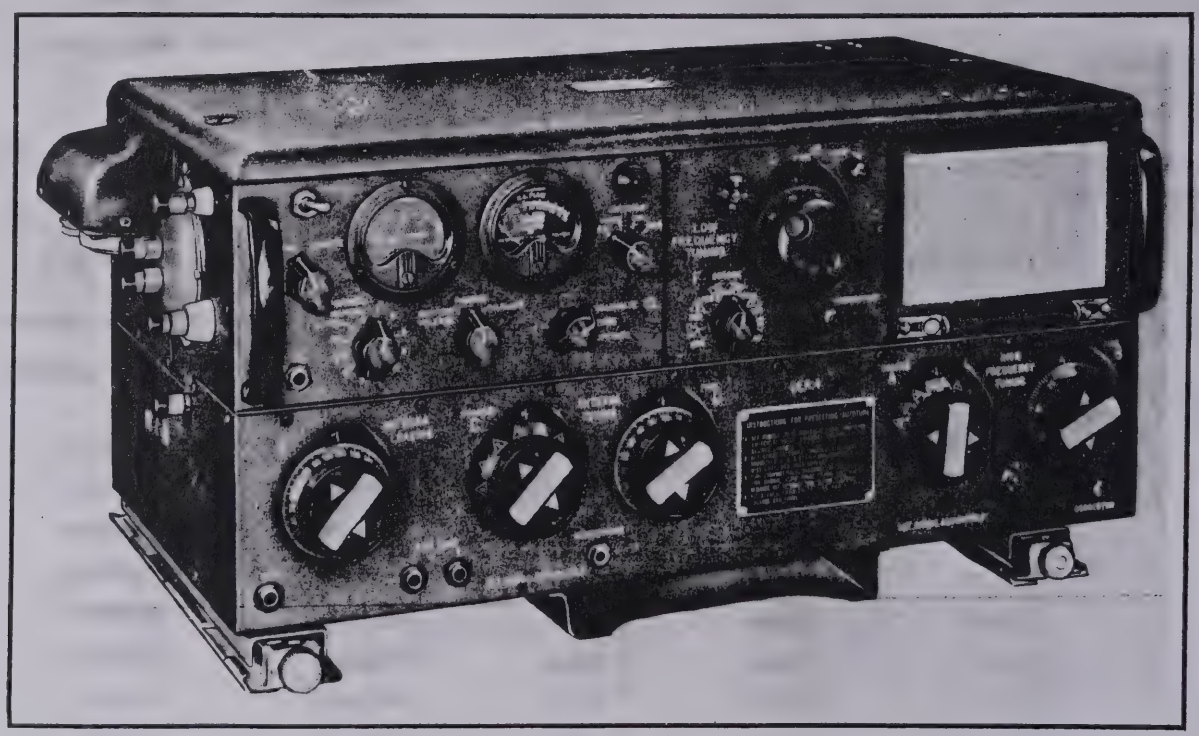
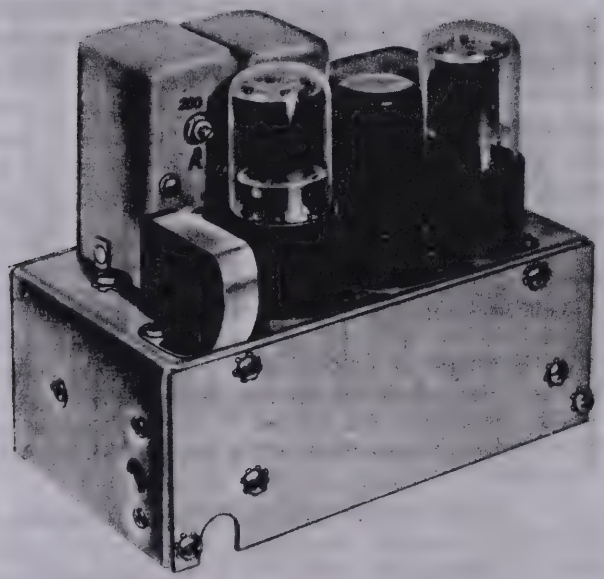


Figure 1-4—Radio Transmitter T-47/ART-13 (Navy Type -52286) with Oscillator 0-16/ART-13 Installed

(1) GENERAL.—Sub-assembly type of construction has been used extensively in the radio transmitter. This type of construction greatly simplifies the removal of component parts without major disassembly of the unit. Vacuum tubes are accessible by removal of the top cover of the transmitter case.

The transmitter proper contains a high frequency oscillator which covers the frequency range 1000 to 1500 kilocycles. A band switch, control "A", connects the proper multiplier circuits to provide operation of the complete transmitter over the frequency range 2000 to 18,100 kilocycles. An internal crystal oscillator permits calibration of the master oscillator at points designated on the calibration tables. The antenna tuning network is incorporated in the transmitter for operation into aircraft antennas. When the radio transmitter is operated in the radio frequency range 3000 to 18,100 kilocycles, the antenna tuning network incorporated in the transmitter is capable of tuning and delivering power into fixed antennas which are between 17 and 65 feet in length. For operation between 2000 and 3000 kilocycles external shunt capacitors may be required in addition to the antenna tuning network in the transmitter to tune and deliver power to fixed aircraft antennas which are between 20 and 60 feet in length. Instructions describing correct use of the shunt capacitor unit are given in section II, paragraph 7*b*(2) (*jj*).

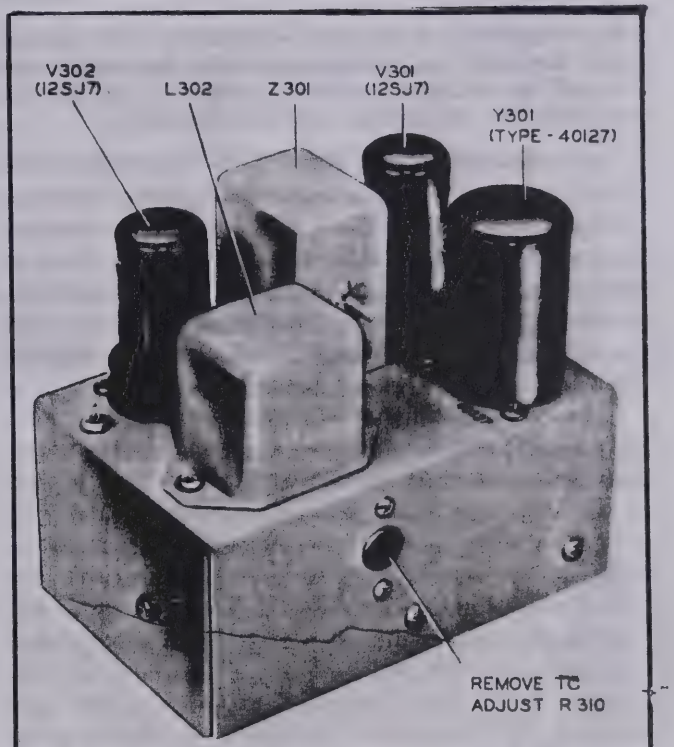
The mountings for the transmitters are shown in figures 2-6 and 2-7. Interchangeability of the mountings is given in the table of section I, paragraph 4.



Note

If this unit is installed, use calibration tables 5-1, 5-2 and 5-3 or tables in Calibration Book for Radio Transmitting Set AN/ART-13A (T.O. No. 16-30ART13-9). (If this unit is installed when Oscillator O-16/ART-13 is used, refer to par. 6A, section V for instructions for calibrating the oscillator.)

Figure 1-5—MCW-CFI 8Q-2 Unit



Note

If this unit is installed, use calibration tables 5-4, 5-5 and 5-6 or any one of editions 1 through 4 of the Calibration Book for Navy Model ATC or ATC-1.

Figure 1-6—MCW-CFI 8Q-1 Unit

Two types of crystal oscillators have been supplied with the transmitters. The MCW-CFI 8Q-1 unit is the original design. (See fig. 1-6.) The later design is known as the 8Q-2 unit. (See fig. 1-5.) The 8Q-2 unit has louder signals at the check points and the check points occur every 50 kilocycles on the master oscillator which spaces them evenly in the calibration tables for a particular band. The distance between them varies with different multiplication factors selected by the band change switch. Different calibration tables are furnished for the different MCW-CFI units in order to indicate the different check points. The figures in the tables are the same regardless of which MCW-CFI unit is used but the position of the check points varies. The units are interchangeable between transmitters providing the proper calibration table is used. Calibration tables 5-1, 5-2, and 5-3 are to be used only when the radio transmitter has an 8Q-2 installed.* (When the radio transmitter has an Oscillator O-16/ART-13 and MCW-CFI 8Q-2 unit installed, refer to par. 6A, section V for calibration instructions for the oscillator.) Calibration tables 5-4, 5-5, and 5-6 are to be used only when the radio transmitter has an 8Q-1 installed.* Determine which is installed before performing adjustments using calibration tables. A

*Calibration tables 5-1 and 5-2 are the same tables which are in "Calibration Book for Radio Transmitting Set AN/ART-13A (T.O. No. 16-30ART13-9)." Calibration tables 5-5 and 5-6 are the same tables which are in editions 1 through 4 for Navy Model ATC.

visual inspection of the radio transmitter with the top cover removed and comparison with figures 1-5 and 1-6 will be sufficient to tell if an 8Q-2 or an 8Q-1 is installed. Use calibration tables accordingly.

(2) RADIO TRANSMITTER T-47A/ART-13. (*See Figure 1-3*).—These transmitters are a redesign of Radio Transmitter T-47/ART-13. Several changes were made to the circuit including addition of an interlock switch and some components were changed. All of these transmitters are shipped from the factory with an 8Q-2 installed and with Panel MX-128/ART-13 installed in place of low frequency oscillators.

(3) RADIO TRANSMITTER T-47/ART-13. (*See Figure 1-4*).—These transmitters are identical to those furnished with Navy Model ATC and ATC-1 equipment. Early production was equipped with MCW-CFI unit 8Q-1. 8Q-2 was incorporated during production. Some transmitters already delivered before this unit was incorporated were modified by modification M2. That modification replaced the 8Q-1 with an 8Q-2 and replaced the calibration book to conform to the changed unit. Transmitters with this modification were marked "M2" beside the nameplate. Modification M1 consisted of the addition of an interlock switch which shuts off high voltage from the radio transmitter when the top cover is removed.

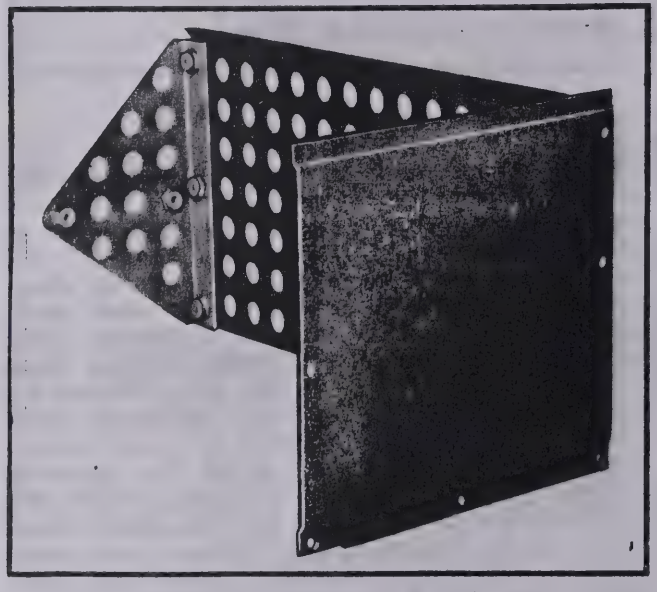


Figure 1-7—Panel MX-128/ART-13

(4) RADIO TRANSMITTERS T-47/ART-13, T-47/ART-13A with CDA-T Crystal Oscillator (See Figure 1-2A). This transmitter includes the original features of each model, excepting that the low frequency unit has been removed and the CDA-T installed in its place. The CDA-T permits operation in the 2000 to 18,000 kilocycles range (crystal controlled and VFO) and with four crystal controlled frequencies, in the low frequency range of 300 to 500 kilocycles.

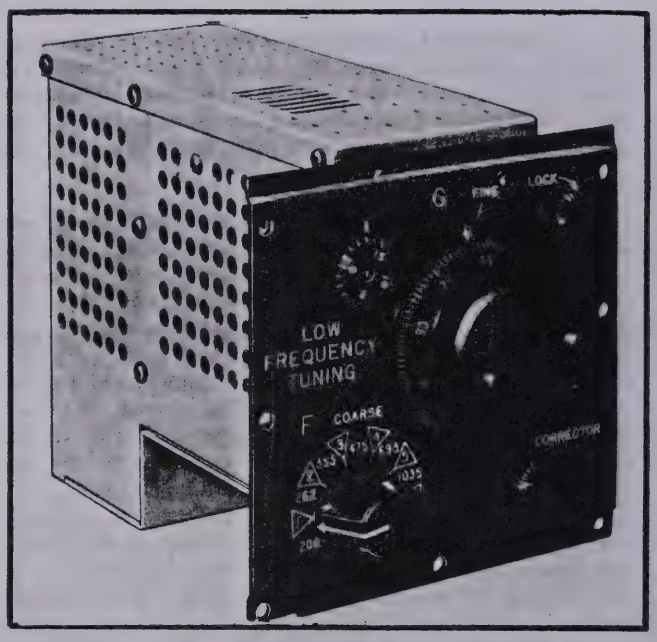


Figure 1-8—Oscillator O-16/ART-13

b. LOW FREQUENCY OSCILLATORS.

(1) GENERAL.—Low frequency oscillators are available for extending the frequency range of the transmitter below 2000 kilocycles. These oscillators are installed in the transmitter proper and obtain their power from the circuits in the transmitter. The front panel of the oscillator, which contains the controls for it, forms a part of the front panel of the transmitter. Check points for the calibration of the low frequency oscillators are obtained from the same MCW-CFI unit that provides check point for the high frequency oscillator in the transmitter. Therefore, care must be exercised in the use of calibration tables to be sure that the proper table is used with the MCW-CFI unit in the transmitter.

(2) OSCILLATOR O-16/ART-13. Figure 1-8 covers the frequency range 200 to 1500 kilocycles. Calibration table 5-3 is for this oscillator with 8Q-2 and calibration table 5-6 is for this oscillator with 8Q-1. The tables in ATC or ATC-1 calibration books, editions 1 through 4 are for this oscillator with 8Q-1. Refer to paragraph 6A, section V for calibration instructions for this oscillator when the MCW-CFI 8Q-2 unit is used.

(3) OSCILLATOR O-17/ART-13A. Oscillator O-17/ART-13A covers the frequency range 200 to 600 kilocycles. Calibration table 5-1 is for this oscillator with 8Q-2 and calibration table 5-4 is for this oscillator with 8Q-1. The tables in the Calibration Book for Radio Transmitting Set AN/ART-13A are for this oscillator with 8Q-2.

(4) PANEL MX-128/ART-13. Figure 1-7 is a blank panel with a resistor to be installed in the transmitter when no low frequency operation is desired. It fills the part of the transmitter panel used for the low frequency oscillator controls and provides the necessary

resistor to replace the filament circuit of the low frequency oscillator tube.

c. ANTENNA LOADING COILS AND SWITCHING UNIT.

(1) GENERAL.—When transmission frequencies in the 200 to 1500 kilocycle range are selected, the antenna tuning and loading circuits, built into the transmitter, are not used and the output of the power amplifier is automatically connected to the loading circuits in external loading coils. Controls are provided on the front panel of the loading coils to permit adjustment of inductive reactance and coupling in order to tune and deliver power to the antenna. A radio frequency ammeter is used in some loading coils to indicate antenna current. Selection of either the trailing wire or fixed aircraft antenna is accomplished by means of a switch knob located on the control panel. Terminal posts facilitate connections to a fixed aircraft antenna, trailing wire antenna, ground (structure of aircraft), the high frequency antenna terminal of the transmitter, the low frequency terminal of the transmitter, and to a 28 volt supply source which is controlled by the output circuit selecting relay (K-105) in the transmitter. The 28 volt d-c source is "keyed" by microphone or telegraph key and actuates a relay in the loading unit. This relay is actuated *only* when control "A" of the transmitter is set on position 13. This low frequency relay connects the aircraft antenna to the "LOAD COIL" terminal of the transmitter thru the circuits of the loading unit when the key or microphone button is pressed. Thus, automatic selection of the correct antenna tuning and loading system is accomplished for either high or low frequency operation when the transmitter controls are being set to the desired transmission frequency. When both the trailing wire antenna and the fixed antenna are connected to the loading unit, only one or the other is actually in use for any transmission frequency. The idle antenna is, at all times, automatically connected to a terminal post on the exterior of the control unit. This terminal (labelled "PLUG PL-259") may be connected to a dissociated receiver.

(2) ANTENNA LOADING UNIT CU-32/ART-13-A. (*See Fig. 1-9*).—The antenna tuning network, low frequency relay, and antenna selector switch are all incorporated in this unit. The network is capable of tuning any antenna (fixed or trailing) 30 to 200 feet in length throughout the range 200 to 600 kilocycles.

(3) ANTENNA LOADING COIL CU-25/ART-13 (*See Fig. 1-10*).—This unit contains a tuning network capable of tuning a trailing wire antenna 200 feet long throughout the range 200 to 600 kilocycles. It will, in addition, tune fixed antennas in the upper portion of that frequency range. Long antennas can be tuned to lower frequencies than short ones.

(4) ANTENNA LOADING COIL CU-26/ART-13 (*See Fig. 1-11*).—This unit contains a tuning network capable of tuning trailing wire antennas 150 feet long

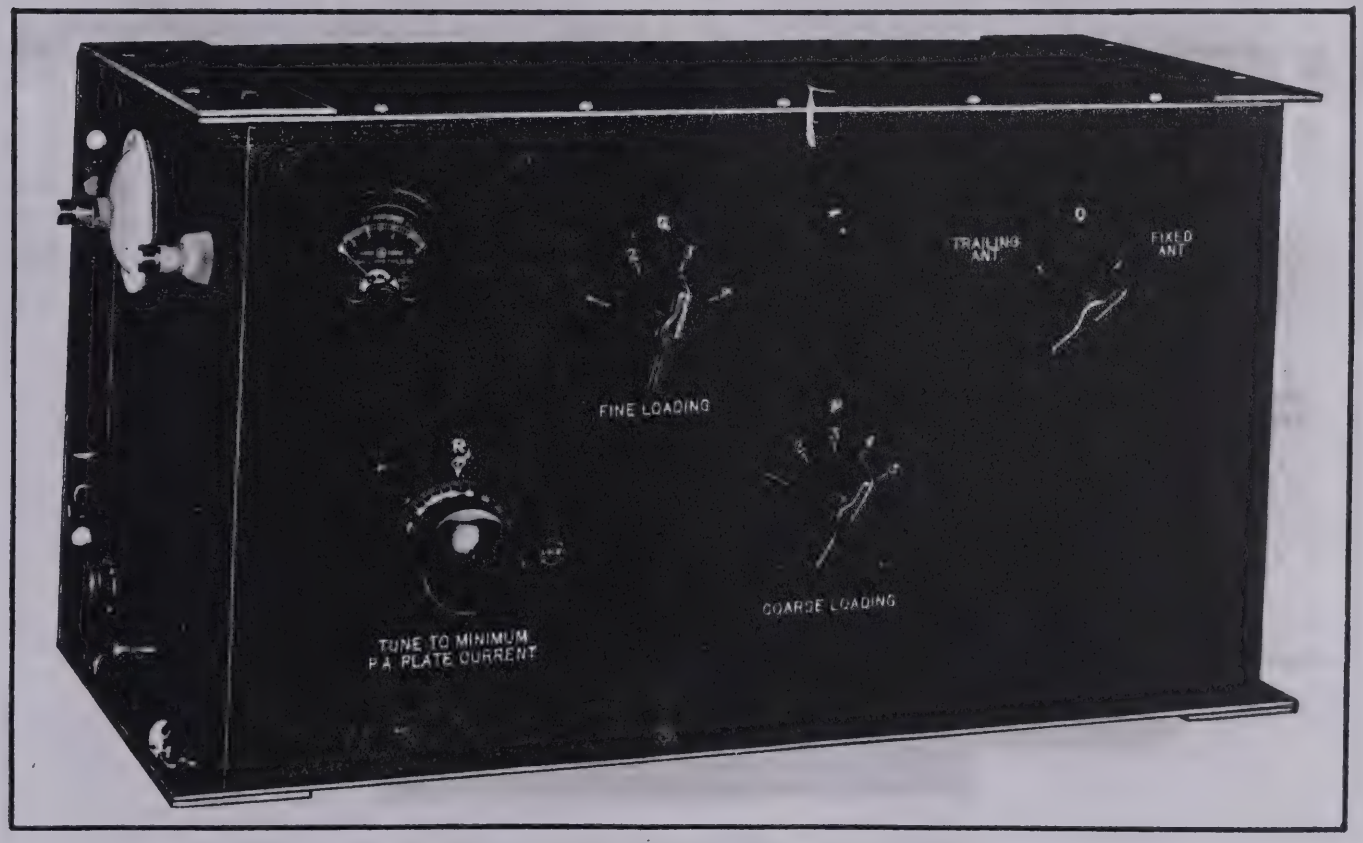


Figure 1-9—Antenna Loading Unit CU-32/ART-13A

throughout the frequency range 1100 to 1500 kilocycles and 200 feet long throughout the frequency range 500 to 1100 kilocycles. In addition, it may be used for tuning long, fixed antennas in a restricted frequency range. Note that this loading coil is not applicable if Oscillator O-17/ART-13A is used.

Note

Late models were furnished without the meter.

Figure 1-10—Antenna Loading Coil CU-25/ART-13 (Navy Type -47281)

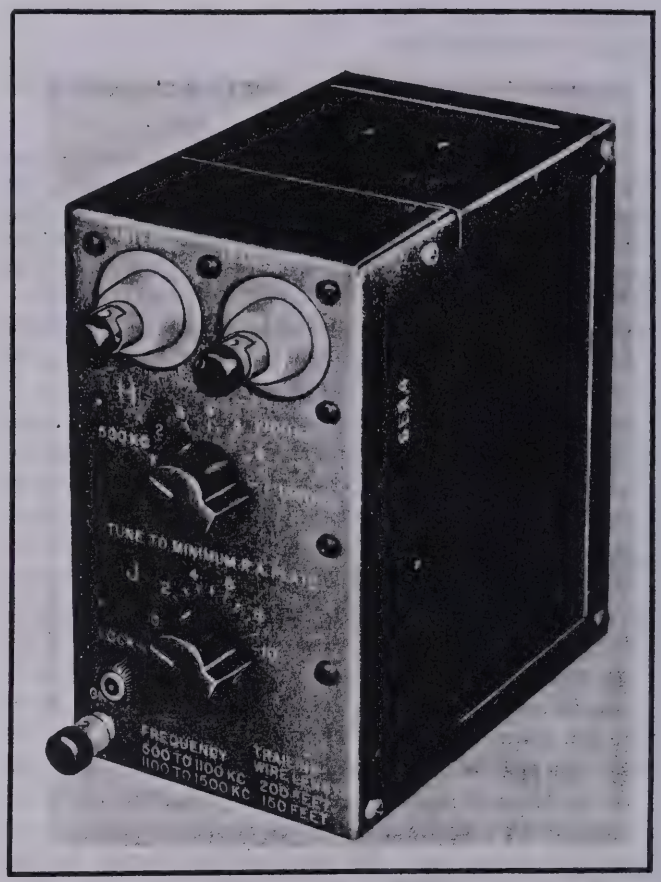


Figure 1-11—Antenna Loading Coil CU-26/ART-13 (Navy Type -47282)

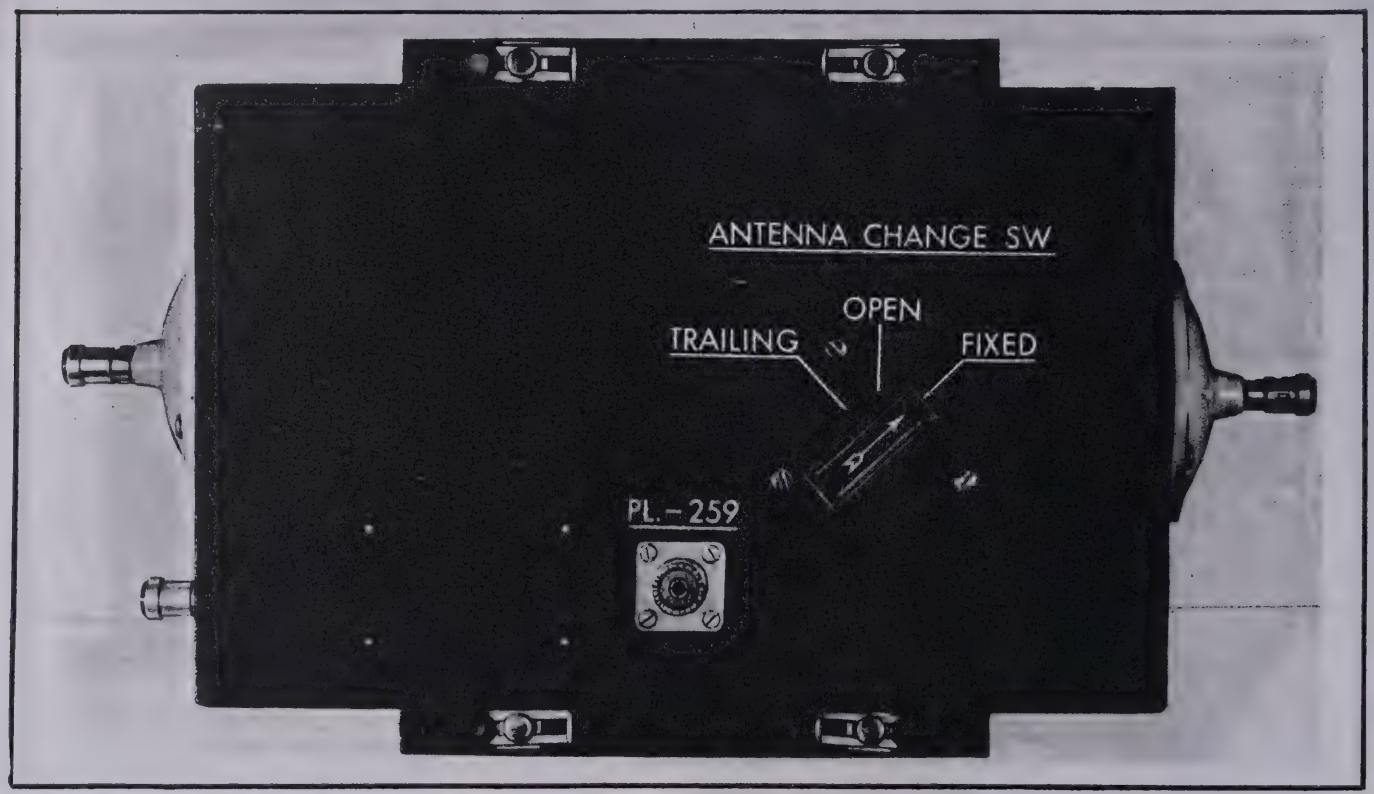


Figure 1-12—Antenna Switching Unit SA-22/ART-13

(5) ANTENNA SWITCHING UNIT SA-22/ART-13 (*See Fig. 1-12.*)—This unit contains the antenna selector switch and the low frequency relay required for use with Antenna Loading Coil CU-25/ART-13 or CU-26/ART-13. When low frequency equipment is not included in the installation, Switch SA-13/U is used for the antenna changeover switch.

(6) MOUNTINGS.—Mounting Base MT-198/ART-13A (fig. 2-10) is supplied for mounting Antenna Loading Unit CU-32/ART-13A. Mounting plate MT-162/ART-13 (fig. 2-11) is supplied for mounting Antenna Loading Coil CU-26/ART-13. Mounting FT-142 is supplied for mounting Antenna Switching Unit SA-22/ART-13.

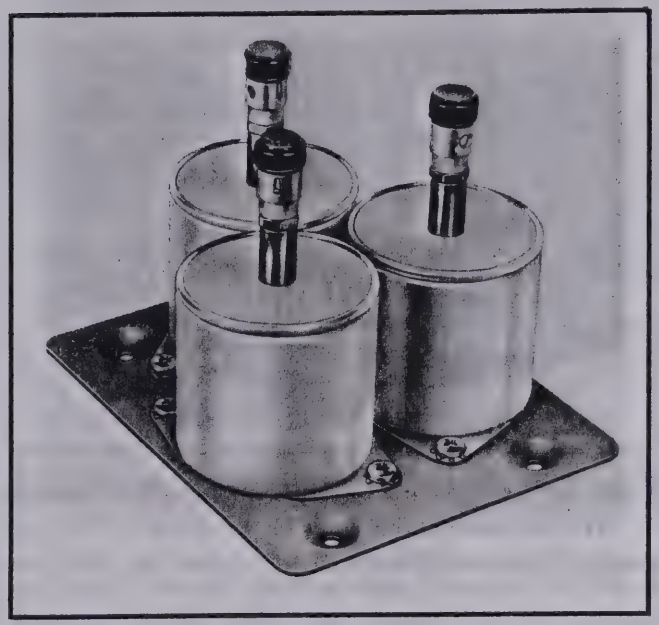


Figure 1-13—Antenna Shunt Capacitor CU-24/ART-13 (Navy Type -481628)

d. ANTENNA SHUNT CAPACITOR AND SWITCH.

(1) Antenna Shunt Capacitor CU-24/ART-13 (see fig. 1-13) is supplied for use with the transmitter. It is used whenever required (see sec. II, par. 7*b*(2)(*jj*)), to properly tune and deliver power to fixed aircraft antennas (20 to 60 feet long) operating in the 2000 to 3000 kilocycle range of transmission frequencies. The shunt capacitor unit consists of three individual 25 micromicrofarad capacitors mounted on a plate which serves as a common connection to one terminal of each unit. Each capacitor may be connected individually or collectively to the antenna system by means of the terminal at the top, thus providing capacitance values of 25, 50, or 75 micromicrofarads.

(2) Mounting holes are provided in the base of the antenna shunt capacitor to facilitate attachment to the aircraft structure.

(3) Switch SA-46/ART-13A (see fig. 1-1) is used to connect Antenna Shunt Capacitor CU-24/ART-13 to the transmitter output circuit ("COND" binding post) when it is required.

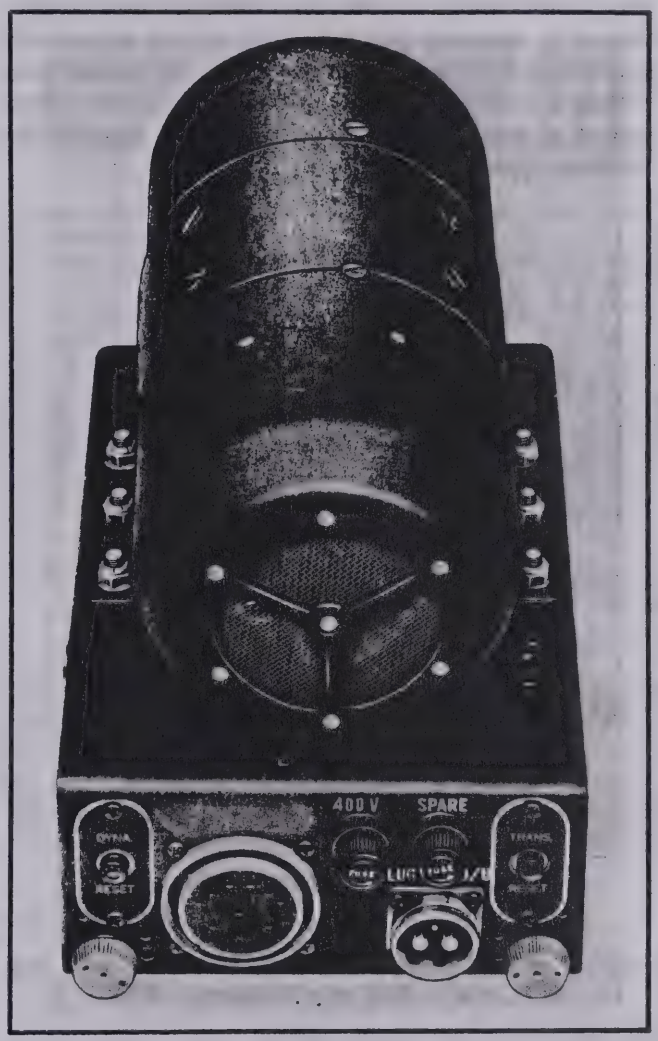


Figure 1-14—Dynamotor Unit DY-17/ART-13A

e. DYNAMOTOR POWER UNIT.

(1) Any one of the following dynamotor power units may be used with this equipment:

(*a*) Dynamotor Unit DY-17/ART-13A (fig. 1-14).

(*b*) Dynamotor Unit DY-12/ART-13 (Navy Model -23333 Power Unit, with Dynamotor -21932).

(*c*) Dynamotor Unit DY-12A/ART-13 (Navy Model -23333 or -23333-A plus -21932).

(*d*) Dynamotor Unit DY-11/ART-13 (Navy Model -23333 Power Unit, with Dynamotor -21931). (See fig. 1-15.)

(2) The dynamotor unit is the power source used for operation of the radio transmitter. It contains a dynamotor machine, barometric switch, control and overload relays, filters and fuse for overload protection of the plate and screen voltage supply circuits of the low power stages. A 28 volt direct current power source is required for operation of the dynamotor machine as well as for the circuits in the transmitter. Voltages as low as 24 volts d-c may be used but reduction in power output and increased time required for Autotune operation will result.

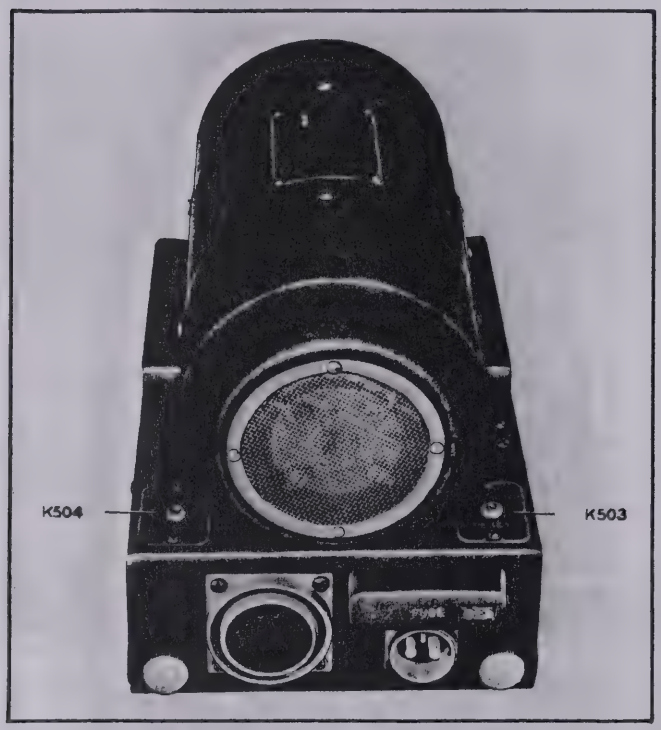


Figure 1-15—Dynamotor Unit DY-11/ART-13 (Navy Type -23333 Power Unit, with Dynamotor -21931)

f. REMOTE CONTROL UNIT

(1) Control Unit C-87/ART-13 (see fig. 1-16) provides a remote control for operation of the transmitter using a variable frequency oscillator unit. By means of the two knobs located on the face of the control unit, the following items may be controlled:

(*a*) Turn power supply on or off.

(*b*) Select type of emission (CW, MCW or VOICE).

(*c*) Select any one of 11 preset transmission frequencies.

(2) Control Unit C-87/ART-13, modified by the addition of an "A-B" channel switch and used with a transmitter employing the CDA-T Crystal Oscillator permits remote control of functions (*a*) and (*b*) as outlined above; and allows selection of any one of 20 frequencies in the range of 2000 to 18,000 kilocycles; and one frequency in the range of 300 to 500 kilocycles.

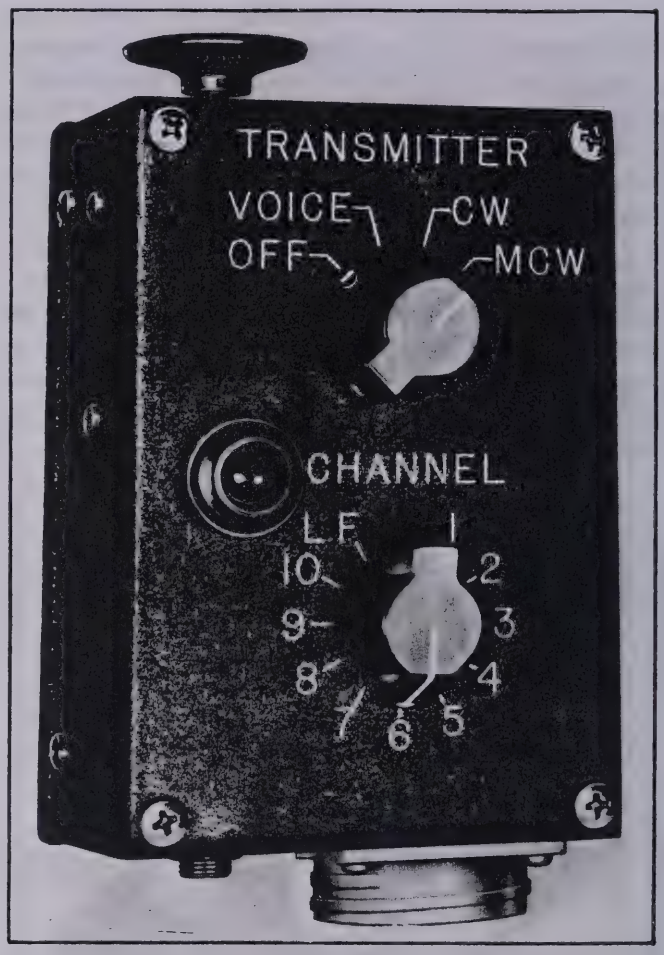


Figure 1-16—Control Unit C-87/ART-13 (Navy Type -23330)

(3) For installations having standardized control panels, Control Panel C-405/A (see fig. 1-17) or C-405A/A replaces and performs all the functions (except key) of Control Unit C-87/ART-13. Control Panel C-405A/A differs from the C-405/A Model in that it has an edge-lighted lucite panel and two panel lamps. It is mechanically and electrically interchangeable with the C-405/A except that it has an additional wire to bring power to the lamps.

Note

Transfer of control from the transmitter panel to the remote control unit is possible only at the transmitter.

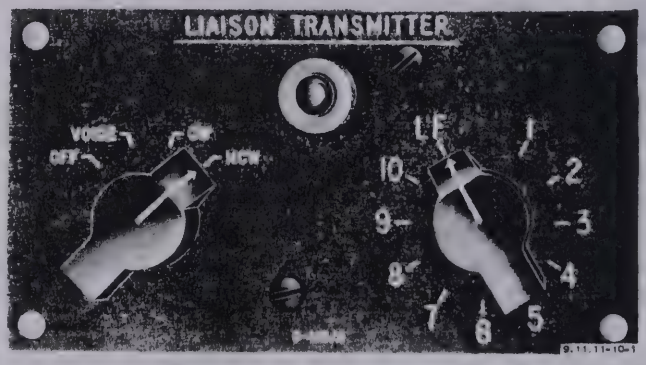


Figure 1-17—Control Panel C-405/A or C-405A/A

SECTION II

INSTALLATION AND ADJUSTMENT

1. UNCRATING RADIO TRANSMITTING SET AN/ART-13A.

Open packing crates as outlined. Use care to avoid damage and search all packing material to be sure that small packages are not overlooked. All crates are marked with arrows to indicate the upright position. Cut and remove banding around crates.

a. TRANSMITTER CRATE.–Keep in upright position and remove cover of crate. Take off waterproof and foil bags. Remove cloth bags containing silica gel. Remove banding frame (holds transmitter to bottom of crate) by taking off 4 bolts. Lift transmitter out of crate.

b. DYNAMOTOR CRATE.–Keep in upright position and remove cover of crate. Remove waterproof and foil bags. Remove cloth bags containing silica gel. Remove 2 clamps holding dynamotor to base and lift out the dynamotor. Remove Kimpak wrapper.

c. CONTROL UNIT.–Remove cover of crate. Lift out cardboard carton containing the unit. Remove unit from carton and take off foil bag and Kimpak wrapper.

d. ANTENNA LOADING UNIT.–Remove cover of crate. Take off waterproof bag and Kimpak wrapper. Remove foil and waterproof bags. Open cardboard carton and take out cloth bags, containing Silica gel. Lift the unit out and remove Kimpak wrapper.

e. ANTENNA SHUNT CAPACITOR.–Remove cover of crate. Lift out cardboard carton containing the unit. Remove unit from carton and take off foil bag and Kimpak wrapper.

2. PREPARATION FOR INSTALLATION.

The equipment should be checked before installation to make sure that all parts are operating properly and that no damage occurred during shipment which might cause early failure in service.

a. MECHANICAL INSPECTION.

(1) TRANSMITTER.

(a) Rotate all switches on the face of the transmitter to see that they operate freely and the knobs are fastened tightly to their shafts.

(b) Inspect the terminals at the left end of the transmitter for proper spring action and broken parts.

(c) Inspect the case and mountings for dents or bent portions which might interfere with operation.

(d) Remove the top cover of the transmitter and

1. Make sure the crystal is in the proper position and clamped securely in place. (See fig. 2-1 when MCW-CFI 8Q-2 Unit is used; see fig. 2-2 when MCW-CFI 8Q-1 Unit is used).

2. Make sure all tubes are mounted securely in the sockets and that tubes JAN-811, JAN-1625, and JAN-837 are locked properly. (See fig. 2-1 or 2-2.)

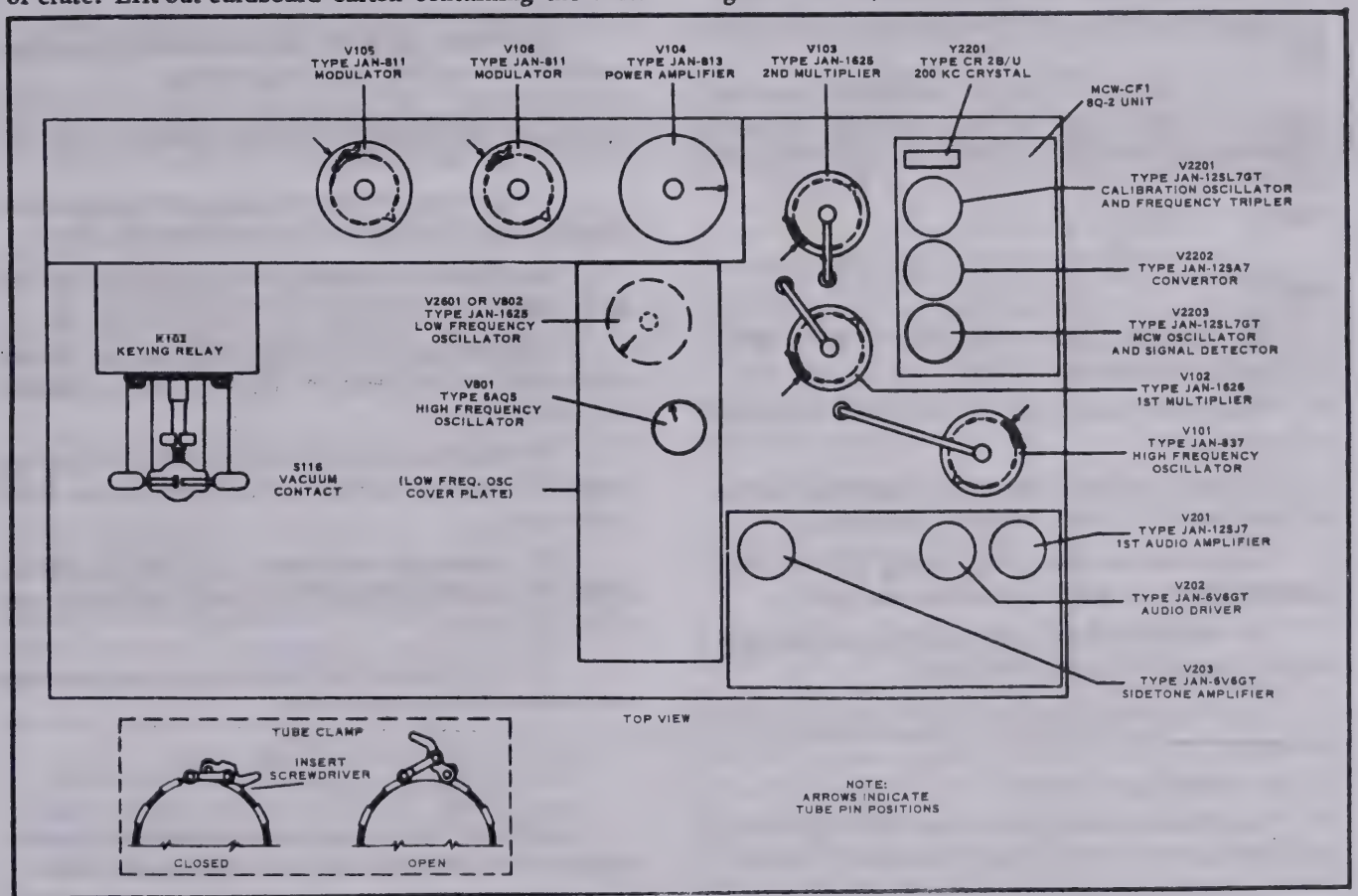

V105 TYPE JAN-811 MODULATOR
V106 TYPE JAN-811 MODULATOR
V104 TYPE JAN-813 POWER AMPLIFIER
V103 TYPE JAN-1625 2ND MULTIPLIER
Y2201 TYPE CR 28/U 200 KC CRYSTAL
MCW-CF1 8Q-2 UNIT
V2201 TYPE JAN-12SL7GT CALIBRATION OSCILLATOR AND FREQUENCY TRIPLER
V2202 TYPE JAN-12SA7 CONVERTOR
V2203 TYPE JAN-12SL7GT MCW OSCILLATOR AND SIGNAL DETECTOR
V102 TYPE JAN-1626 1ST MULTIPLIER
V101 TYPE JAN-837 HIGH FREQUENCY OSCILLATOR
V201 TYPE JAN-12SJ7 1ST AUDIO AMPLIFIER
V202 TYPE JAN-6V6GT AUDIO DRIVER
V203 TYPE JAN-6V6GT SIDETONE AMPLIFIER
K101 KEYING RELAY
S116 VACUUM CONTACT
V2601 OR V802 TYPE JAN-1625 LOW FREQUENCY OSCILLATOR
V801 TYPE 6AQ5 HIGH FREQUENCY OSCILLATOR
(LOW FREQ. OSC COVER PLATE)
TOP VIEW
TUBE CLAMP
INSERT SCREWDRIVER
CLOSED
OPEN
NOTE: ARROWS INDICATE TUBE PIN POSITIONS

Figure 2-1—Radio Transmitter T-47A/ART-13 and Oscillator O-17/ART-13A (or Oscillators O-16/ART-13 or CDA-T)—Tube Placement Diagram

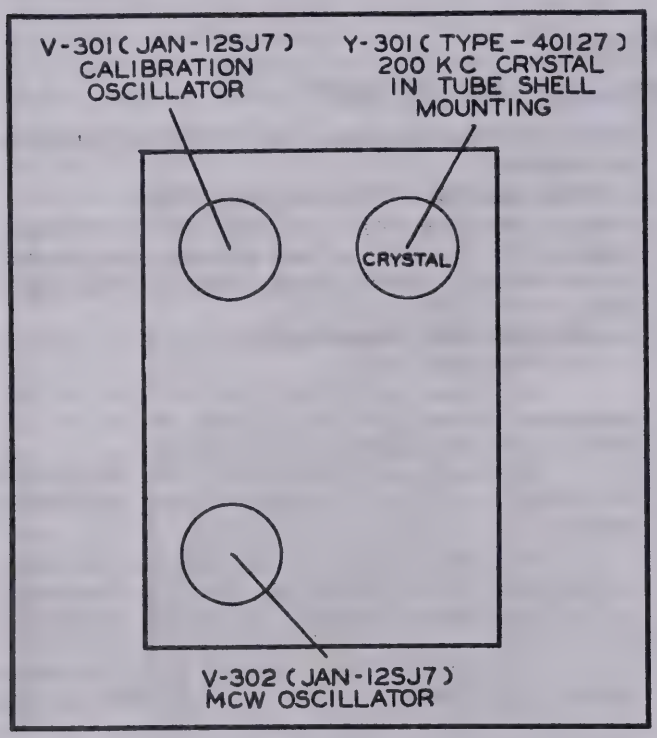


Figure 2-2—MCW-CFI 8Q-1 Unit—Tube Placement Diagram (see fig. 2-1)

3. Make sure the plate connector caps on all tubes employing them are in the proper position and firm.

4. If the low frequency oscillator is installed, remove the cover from the low frequency oscillator and check the tube for proper seating in the socket, and firm and proper connection of the plate cap. Replace the cover.

5. Check the vacuum switch to be sure it is not broken.

(*e*) Replace the top cover of the transmitter.

(2) DYNAMOTOR UNIT.

(*a*) Check the fuse and spare fuse to see that they are serviceable.

(*b*) Remove the bottom plate and check all relays and stand off insulators for broken parts.

(c) Check the relays by closing them by hand to see that they do not bind and are not bent.

(*d*) Make sure all circuit elements are mounted securely. Replace the bottom cover.

(*e*) Make sure the end cover mounting bolts are tight.

(3) CONTROL UNIT.

(*a*) Turn the switches to make sure they function properly and the knobs are not loose on the shafts.

(*b*) Press the key to check the spring action and make sure the mechanism does not bind and stick.

(*c*) Remove the back plate and inspect the switches for broken parts. Replace the plate.

(4) ANTENNA SHUNT CAPACITOR.

(*a*) Inspect to see that no parts are bent or broken.

(*b*) Check spring action of all terminals.

(5) ANTENNA LOADING UNIT CU-32/ART-13-A.

(*a*) Turn the switches to make sure they function properly and the knobs are not loose on the shafts.

(*b*) Check all terminals for broken parts and spring action.

(*c*) Remove the cover and inspect all switches for broken parts.

(*d*) Make sure that none of the leads are broken or bent in a manner that reduces spacing between leads or the case.

(*e*) Rotate the variometer ("TUNE TO MINIMUM PA PLATE CURRENT" knob) and make sure it does not bind.

(*f*) Make sure vacuum switch is not broken.

(*g*) Make sure micalex terminal board is not broken.

(*h*) Check all stand off insulators to see that none are broken and replace the cover.

(6) ANTENNA LOADING COIL CU-25/ART-13.

(*a*) Turn the switches to make sure they function properly and the knobs are not loose on the shafts.

(*b*) Check all terminals for broken parts and spring action.

(*c*) Remove the case by removing the screws around the extreme edge of the front panel. Inspect for broken parts.

(*d*) Make sure that none of the leads are broken or bent in a manner that reduces spacing between leads or the case.

(*e*) Rotate the variometer ("TUNE TO MINIMUM PA PLATE CURRENT" knob) and make sure it does not bind.

(*f*) Check all stand off insulators to see that none are broken. Replace the cover.

(7) ANTENNA LOADING COIL CU-26/ART-13.

(*a*) Turn the switches to make sure they function properly and the knobs are not loose on the shafts.

(*b*) Check all terminals for broken parts and spring action.

(*c*) Remove Mounting Plate MT-162/ART-13 (left side of case) by loosening the captive screws on the right side of the case. Inspect for broken parts.

(*d*) Make sure that none of the leads are broken or bent in a manner that reduces spacing between leads or the case.

(*e*) Rotate the variometer ("TUNE TO MINIMUM PA PLATE CURRENT" knob) and make sure it does not bind.

(*f*) Check all stand-off insulators and shaft insulators to see that none are broken.

(*g*) Replace Mounting Plate MT-162/ART-13.

(8) ANTENNA SWITCHING UNIT SA-22/ART-13.

(*a*) Turn the switches to make sure they function properly and the knobs are not loose on the shafts.

(*b*) Check all terminals for broken parts and spring action.

(*c*) Remove the cover and inspect the switch for broken parts.

(*d*) Make sure that none of the leads are broken or bent in a manner that reduces spacing between leads or the case.

(*e*) Rotate the variometer ("TUNE TO MINIMUM PA PLATE CURRENT" knob) and make sure it does not bind.

(*f*) Make sure micalex terminal board is not broken.

(9) CAPACITOR CONNECTING SWITCH.

(*a*) Inspect all ceramic parts to make sure none are broken.

(*b*) Check spacing of jumper leads to make sure it has not been shortened by improperly bent wires.

b. BENCH TEST.

(1) GENERAL.—Check the complete equipment for proper operation before installation in the aircraft. Where numerous installations are to be made, it is recommended that a test bench be set up.

Note

Adjustment procedures for the equipment must be thoroughly understood before making any of the following tests. (See paragraph 7, this section.)

(2) EQUIPMENT REQUIRED.

(*a*) Complete mock-up including all necessary cables and plugs and one station box with liaison position connected into the mock-up.

(*b*) A 28-volt direct current power source with a capacity of 35 amperes per transmitter being tested.

(*c*) Suitable phantom antenna (Antenna A-58).

(*d*) Head Set HS-33.

(*e*) Microphone T-17, or Microphone T-30 with Cord CD-318 or CD-508.

(*f*) Means for checking continuity. This may be a continuity meter or just a battery and light bulb.

(*g*) Plug PL-55 with the terminals shorted.

(3) TEST PROCEDURE—VARIABLE FREQUENCY OSCILLATOR OPERATION.

(*a*) Connect the components in the bench mock-up with Antenna A-58 connected to the "FIXED ANTENNA" ("FIXED" terminal when using Antenna Switching Unit SA-22/ART-13) terminal on the antenna loading unit.

(*b*) Turn "EMISSION" switch to "VOICE" position and "CHANNEL" switch to position "1".

(*c*) Set the antenna selector switch on the antenna loading unit on "FIXED ANT." position ("FIXED" when using Antenna Switching Unit SA-22/ART-13) and the switch on Antenna A-58 on position "4." Set and lock the transmitter controls on 2400 kilocycles (control "A" on 1) on channel 1 in accordance with the operating instructions for CW operation and using the crystal frequency indicator. Check "P.A.GRID" meter reading to make certain the grid drive to the final amplifier tube is within limits.

(*d*) Cycle the autotune into channel 1 by moving "CHANNEL" switch to position "2" until the autotune motor starts and then back to position "1." Close "TEST" switch after cycling is completed. The "P.A. PLATE" reading should be very close to that obtained when the channel was set up.

(*e*) Plug the shorted Plug PL-55 into "T.S." jack and "KEY" jack in turn. Power should be delivered to the antenna in each case.

(*f*) Lift the calibration chart on the face of the transmitter and make sure that microphone selector switch S201 is in the "CARBON" position and safety wired. (See fig. 2-3.) Turn "EMISSION" switch to "VOICE," plug the microphone into "MICROPHONE" jack, and press the button. Power should be delivered to the antenna and the plate current should be slightly above that for CW operation. Speak or whistle into the microphone. Plate current should rise near or higher than the "MCW" area on the meter with modulation.

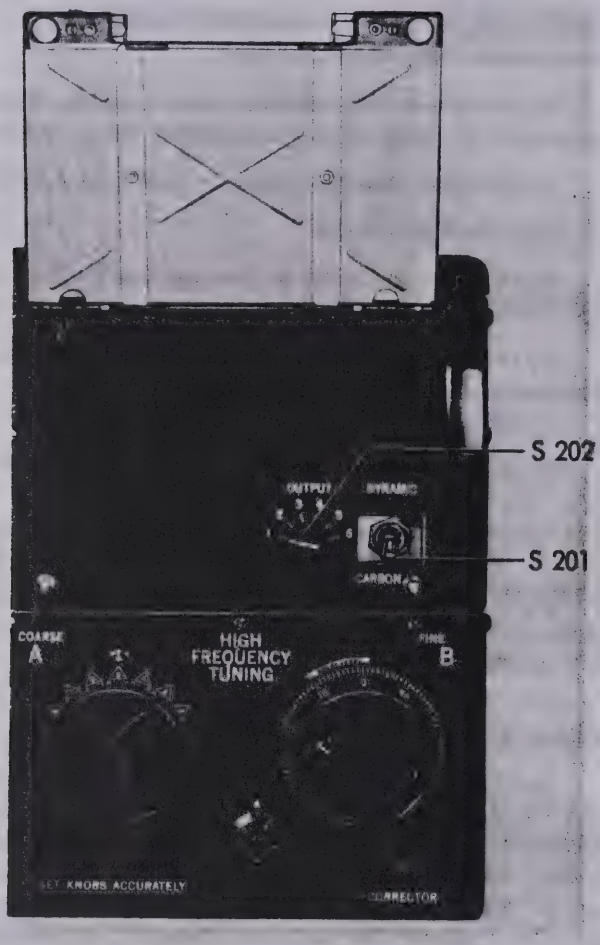
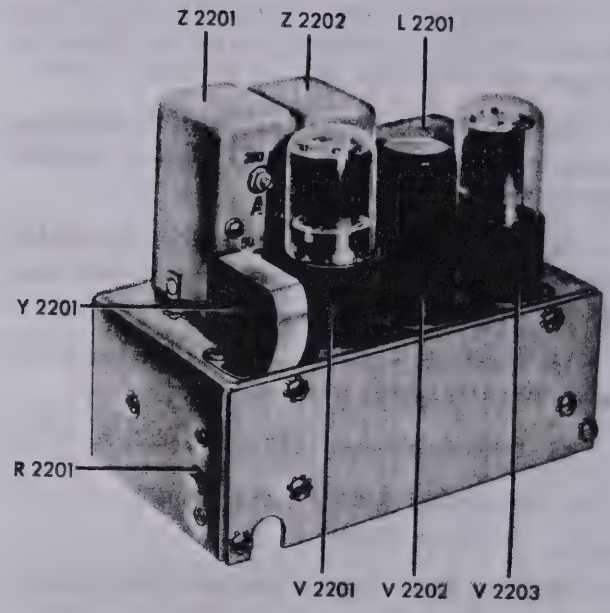


Figure 2-3—Microphone Selector Switch and Sidetone Output Switch

(*g*) Place "EMISSION" switch on "MCW" position and close "TEST" switch. Power should be delivered to the antenna and the plate current meter should read 190 or higher. If this reading is not obtained, readjust the MCW control until a reading of at least 190 is secured. This screwdriver adjustment is located inside the transmitter and is reference number R-2201 when using the MCW-CFI 8Q-2 Unit (see fig. 2-4), and is reference number R-310 as shown in figure 2-5 when the transmitter employs the MCW-CFI 8Q-1 Unit.

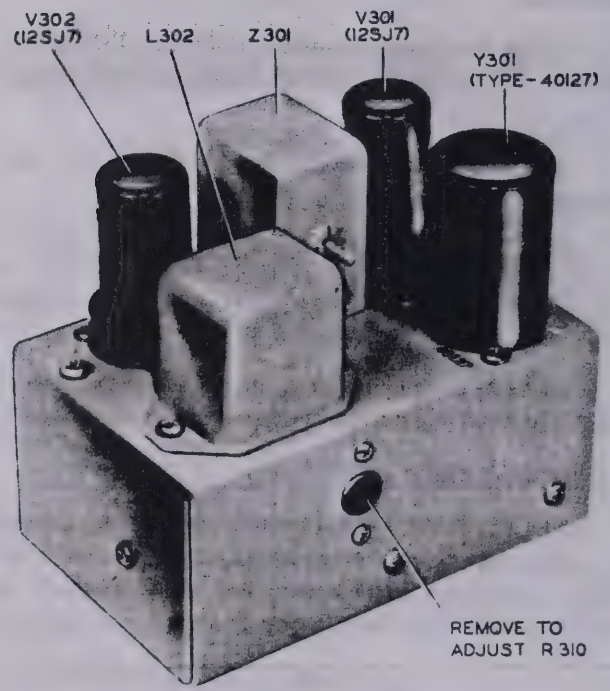
(*h*) Listen in the "SIDETONE 1" circuit and key the transmitter on "CW," "MCW," and modulate on "VOICE" position. The proper sidetone signal should be heard on all emission positions. Repeat with head sets plugged into the station box connected as a part of the mock-up. Lift the calibration chart the set "OUTPUT" switch S202 on each position in turn. (See fig. 2-3.) The proper sidetone signal should be heard on each position, being louder the higher the number of the switch position.



Note

If this unit is installed, use calibration tables 5-1, 5-2 and 5-3 or tables in Calibration Book for Radio Transmitting Set AN/ART-13A (T. O. No. 16-30ART13-9). (If this unit is installed when Oscillator O-16/ART-13 is used, refer to par. 6A, section V for instructions for calibrating the oscillator.)

Figure 2-4—MCW-CFI 8Q-2 Unit—Showing R-2201



Note

If this unit is installed, use calibration tables 5-4, 5-5 and 5-6 or any one of editions 1 through 4 of Calibration Book for Navy Model ATC or ATC-1.

Figure 2-5—MCW-CFI 8Q-1 Unit—Showing R-310

(*i*) Set up and lock the other channels of the autotune by loading the transmitter into the phantom antenna, with controls "A" and "B" set as follows:

Channel	*A*	*B*
2	2	200
3	3	100
4	4	060
5	5	100
6	6	100
7	7	100
8	8	100
9	9	100
10	10	100

(*j*) Place the switch on Antenna A-58 on position "3."

(*k*) Set up the "L.FREQ." channel on 400 kilocycles using the internal CFI.

(*l*) Place the switch on Antenna A-58 on position "4."

(*m*) Place "CHANNEL" switch on "MANUAL," power level switch on "TUNE," meter switch on "P.A. GRID," control "B" on 100, control "C" on 13, control "A" on 11, and close "TEST" switch. The meter should read in or slightly above the lightly shaded area under "P.A.GRID." Repeat with control "A" on position 12.

(*n*) If the installation includes the antenna shunt capacitor, close its connecting switch and tune the transmitter near 2300 kilocycles. Open the switch.

(*o*) Turn "EMISSION" switch to "OFF."

(*p*) Change the phantom antenna lead from the "FIXED ANTENNA" ("FIXED" terminal on Antenna Switching Unit SA-22/ART-13.) terminal on the antenna loading unit to the "TRAILING ANTENNA" ("TRAILING" terminal on Antenna Switching Unit SA-22/ART-13) terminal and set the switch to the "TRAILING ANT." ("TRAILING position on Antenna Switching Unit SA-22/ART-13) position.

(*q*) If the installation includes the remote control unit, set "LOCAL REMOTE" switch on "REMOTE" position, the emission switch on the remote control unit on "VOICE," and "CHANNEL" switch on position "1." Then place the emission switch on "CW." Wait for the light on the control unit to come on.

(*r*) Press the key on the control unit. Power should be delivered to the antenna and the meter should read in the area marked "CW." Meter readings should be very close to those obtained previously.

(*s*) Check operation on "VOICE" from the control unit by means of its emission switch and the microphone jack on it.

(*t*) Select channels "2" to "L.F." on the control unit in turn, closing the key each time the autotune completes cycling. Operation should be normal on each; meter readings, plate and antenna, should be very close to those obtained previously.

(*u*) Disconnect the wires from the "ANT." and "LOAD COIL" posts and check continuity between the "RECEIVER" and ground posts. They should be open with the key up and closed with the key down. Remove the input plug from the dynamotor unit and then check continuity between the "ANT" and "RECEIVER" posts. They should be connected.

(4) TEST PROCEDURE—CRYSTAL OSCILLATOR OPERATION

(*a*) With the CDA-T Crystal Oscillator in use, VFO operation is still obtainable in the frequency range of 2000 to 18,100 kilocycles, by throwing the "VFO/-XTAL" switch to the "VFO" position. Then follow instructions as outlined in paragraph (3), (*a*) through (u) of Section II.

(*b*) For crystal operation in the frequency range of 2000 to 18,000 kilocycles:

1. Turn the "VFO/XTAL" switch to "XTAL", and the "A-B" switch to "A".

2. Follow procedure outlined in paragraph (3) (*a*) through (*b*), of Section II. It will be noted that the "P.A. GRID" meter reading will be lower for Crystal operation than for VFO; how much lower depends to a great extent on the frequency in use. "P.A.PLATE" meter readings may also vary, but not to the same extent as the "P.A.GRID". While a definite "P.A.GRID" reading cannot be specified for crystal operation, it should never go below the "40" indication on the meter. Remember that these readings are for comparison purposes only, and do not represent any definite amount of grid drive.

3. After this channel has been checked with the "A-B" switch setting on "A", switch to "B", and note the differences if any, between the two frequencies. It may sometimes be necessary to adjust the transmitter's loading and calibration settings to a midway point between the "A" and "B" settings, to obtain the maximum average output.

4. Set up channels 2 through 10, as outlined above for channel 1.

(*c*) For crystal operation in the frequency range of 300 to 500 kilocycles:

1. Set "VFO/XTAL" switch to "XTAL"; the 4-position switch on the CDA-T Unit to position "1"; and the transmitters channel to "L.FREQ.", (which should position the "A" dial to it's #13 setting). If the transmitter's "A" dial is not on #13. it should be set manually or by re-setting the Autotune.

2. Check the "P.A.GRID" and "P.A.PLATE" meter indications as previously outlined for the higher frequency range, keeping in mind that these indications will also vary on the low frequency range from VFO operation.

3. Turn the 4-position switch on the CDA-T Unit to each position, and re-check as outlined above.

(*d*) For crystal operation—Remote control.

1. Follow instructions as outlined in paragraph (3) (*q*) through (u).

2. To obtain 2 frequencies on each of the 1 through 10 channels, throw the "A-B" switch to each of its positions. Only 1 low frequency is obtainable on remote control, and it depends on the setting of the 4-position switch on the transmitter's CDA-Unit.

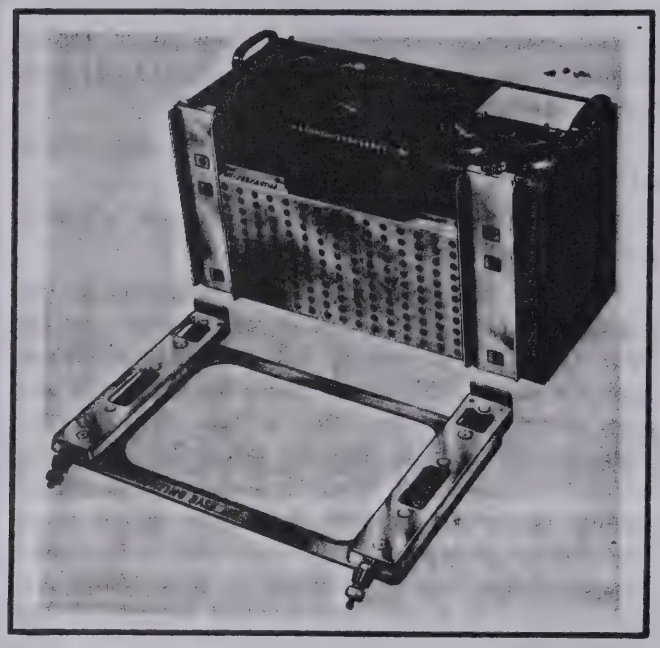


Figure 2-6—Radio Transmitter T-47A/ART-13 with Mounting Base MT-284/ART-13 and Mounting Plate MT-283/ART-13

3. INSTALLATION.

a. TRANSMITTER.—Mount the transmitter at a height convenient for operation of the controls. Outline dimensions, ventilation provisions, clearances required for operation and removal, bonding and mounting hole sizes and placement are shown in figures 5-1 and 5-2.

(1) To install the unit on Mounting Base MT-284/ART-13, the transmitter must be equipped with Mounting Plate MT-283/ART-13. After Mounting Base MT-284/ART-13 has been installed in the aircraft in accordance with figure 5-1, set the transmitter on the mounting with the channels engaged, slide it backwards to engage the holding pins and tighten the locking knobs on the front of the transmitter by turning them clockwise until tight. Be sure the holding pins on the back of the unit engage the proper holes before tightening the locking knobs. Safety wire the locking knobs in position.

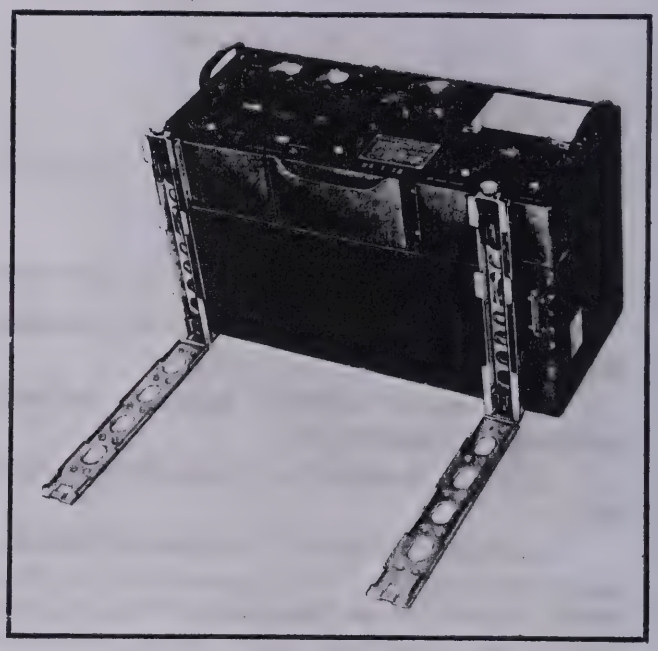


Figure 2-7—Radio Transmitter T-17/ART-13 with Mounting Base MT-161/ART-13 (Navy Type -52286 Transmitter)

(2) To install the unit on Mounting Bases MT-161/ART-13, the transmitter must be equipped with the two channel shock mounts and the perforated tray. After the mounting bases have been installed in the aircraft in accordance with figure 5-2, either slide the transmitter in from the front or set the unit on top of the mounting bases approximately 2 inches forward of its proper position. Slide the unit back as far as it will go and lock it by turning the knobs on the front of the transmitter in a clockwise direction until they are tight. Fasten the locking knobs in position with safety wire.

b. DYNAMOTOR UNIT.—Locate the dynamotor unit in such a position that it will be possible to reach the "RESET" buttons and the "FUSE" on the front of the unit while in flight. Both ends must be at least three inches from a flat surface to provide sufficient ventilation.

Figure 5-3 shows outline dimensions, plug clearances, bonding and mounting hole positions and sizes for Dynamotor Unit DY-17/ART-13. Similar information for Dynamotor Units DY-11/ART-13, DY-12/ART-13 and DY-12A/ART-13 is contained in figure 5-4.

To install the dynamotor unit on the mounting plate, set it on the mounting and slide it backward until the holding pins are engaged, then tighten the two locking knobs on the front of the unit by turning them clockwise.

(1) Safety wire Dynamotor Unit DY-11/ART-13, DY-12/ART-13, or DY-12A/ART-13 by wiring the two locking knobs together. See figure 2-9.

(2) Safety wire Dynamotor Unit DY-17/ART-13 by passing the wire through one of the holes in the knob and the hole in the corner of the filter and relay box. See figure 2-8.

c. ANTENNA LOADING EQUIPMENT FOR LOW FREQUENCY OPERATION.— For the frequency range 200 to 600 kilocycles either Antenna Loading Unit CU-32/ART-13A with its associated Mounting Base MT-198/ART-13A or Antenna Loading Coil CU-25/ART-13 and Antenna Switching Unit SA-

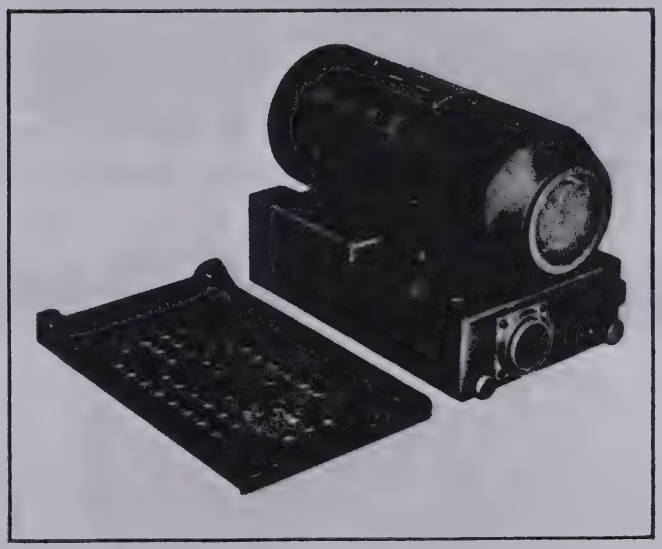


Figure 2-8—Dynamotor Unit DY-11/ART-13 (Navy Type -23333 Power Unit, with Dynamotor -21931)—with Mounting Plate MT 164/ART-13

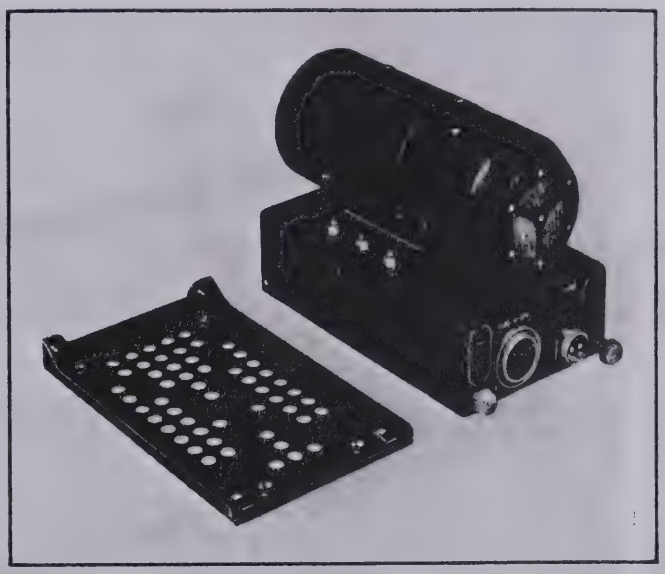


Figure 2-9—Dynamotor Unit DY-17/ART-13A with Mounting Plate MT-164/ART-13

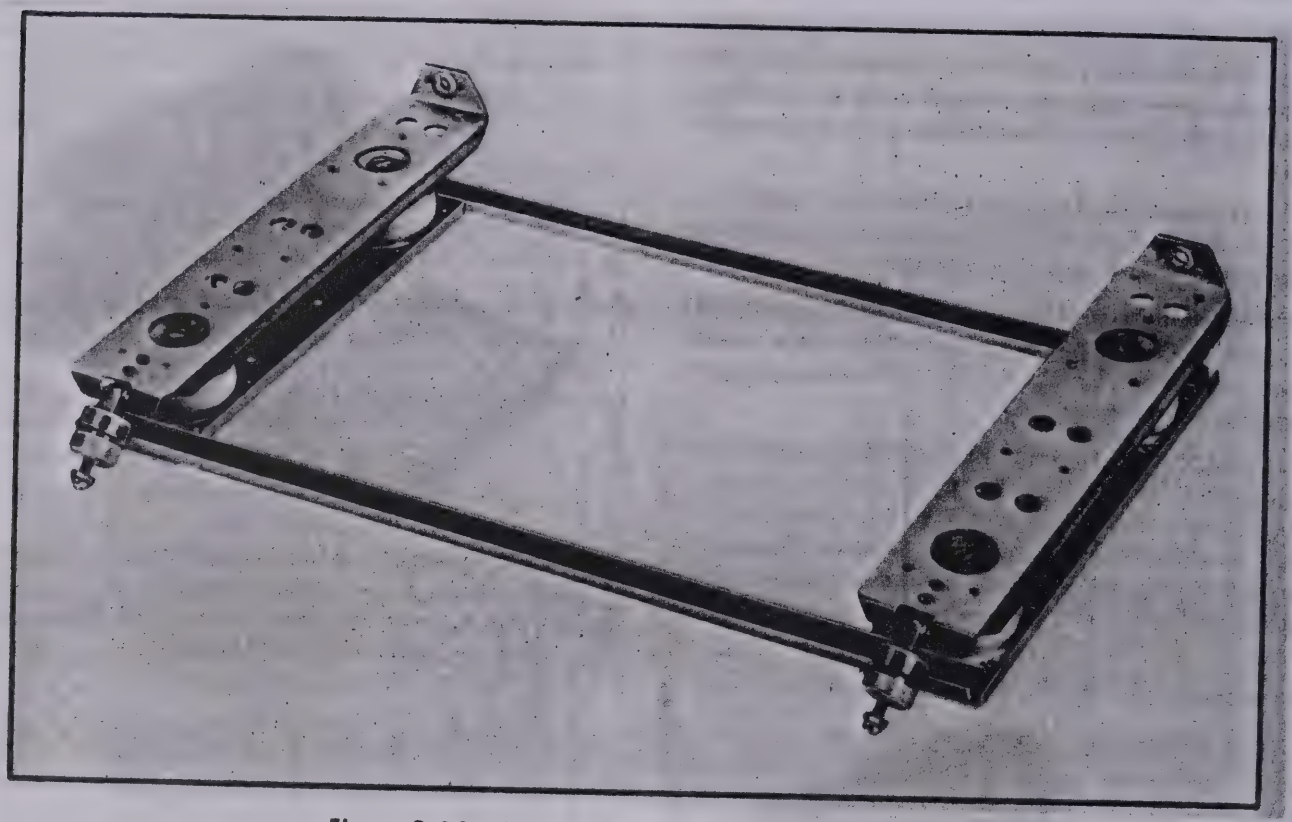


Figure 2-9A—Mounting Base MT-284A/ART-13

22/ART-13 with Mounting FT-42 may be used. For the frequency range 500 to 1500 kilocycles, use Antenna Loading Coil CU-26/ART-13 with Mounting Plate MT-162/ART-13 and Antenna Switching Unit SA-22/ART-13 with Mounting FT-142. If operation below 2000 kilocycles is not required in the installation, install Switch SA-13/U in place of loading or switching units. For outline dimensions, see figure 5-10.

Mount the loading and switching units within easy reach of the operator. Provide at least 6 inches of clearance between electrical terminals on each side of the units and surrounding objects.

(1) ANTENNA LOADING UNIT CU-32/ART-13A AND MOUNTING BASE MT-198/ART-13A.

(*a*) Figures 5-5 and 5-6 show outline dimensions, required clearances, mounting hole locations, and bonding instructions for these units. The loading unit may be attached to the mounting plate in either of the positions shown. Snap slides are used to secure the loading unit to the mounting base. Duplicate sets of snap slides are provided on the top, back, and bottom of the loading unit case. Thus, the mounting base may be located above or below the loading unit, and the unit may be mounted facing out, up, or down.

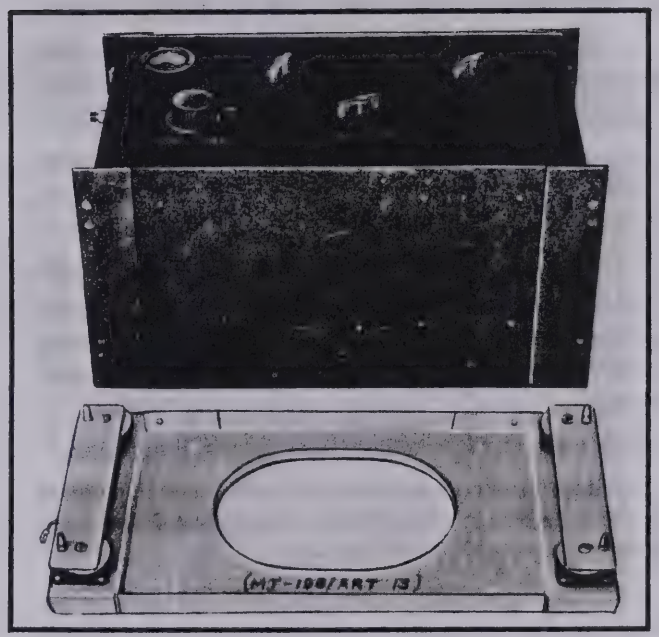


Figure 2-10—Antenna Loading Unit CU-32/ART-13A with Mounting Base MT-198/ART-13A

(*b*) The mounting base is mounted on the structure of the aircraft by means of eight ¼ screws (see fig. 5-4 for location of holes.)

(*c*) After the mounting base has been installed, place loading unit in position on mounting base and secure by closing all four snap slides (one on each corner of the case.) Safety wire the four snap slides.

(2) ANTENNA LOADING COIL CU-25/ART-13 (NAVY TYPE -47281).
(*See Fig. 1-10.*)

(*a*) Figure 5-7 shows the outline dimensions and the distances between centers of the mounting holes. The loading coil may be mounted using holes on either of the two sides, top, bottom or rear of the case.

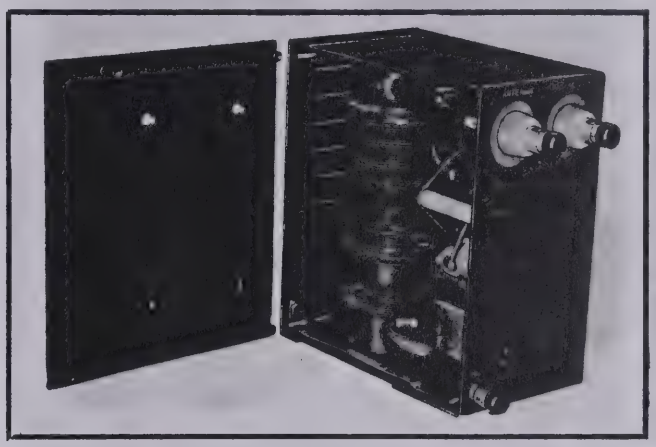


Figure 2-11—Antenna Loading Coil CU-26/ART-13 with Mounting Plate MT-162/ART-13 (Navy Type -47282)

(*b*) To mount the case, remove the front panel by removing the panel securing screws and pulling the panel forward. All unit components are attached to the panel; therefore, the removal of the front panel leaves the case free for mounting. Approximately 11⅛ inches clearance between the unit front panel and nearest obstruction is necessary for removal of the unit from the case.

(3) ANTENNA LOADING COIL CU-26/ART--13 (NAVY TYPE -47282).
(*See Fig. 2-11.*)

(*a*) Figure 5-9 shows the outline dimensions and the distances between centers of the mounting holes. Mounting Plate MT-162/ART-13 is used to mount the unit. That plate is a part of the case (the left side) of the unit and is, therefore, delivered installed on the unit.

(*b*) To mount this unit, remove Mounting Plate MT-162/ART-13 by loosening the four captive screws on the right side of the unit and fasten the mounting plate to the structure of the aircraft. Fasten the unit to the mounting plate by means of the captive screws.

(4) ANTENNA SWITCHING UNIT SA-22/ART-13.

(*a*) Figure 5-8 shows the outline dimensions and position and size of mounting holes. Mounting FT-142 is used to mount the unit.

(*b*) Fasten the mounting to the aircraft and then mount the unit by means of the four snap slides. Safety wire and the snap slides in position.

(*c*) Connect a two-conductor cable between the antenna switching unit and the transmitter. Insert the male connector Plug U-11/U into the transmitter and the female connector, Plug U-12/U, into the receptacle on the switching unit.

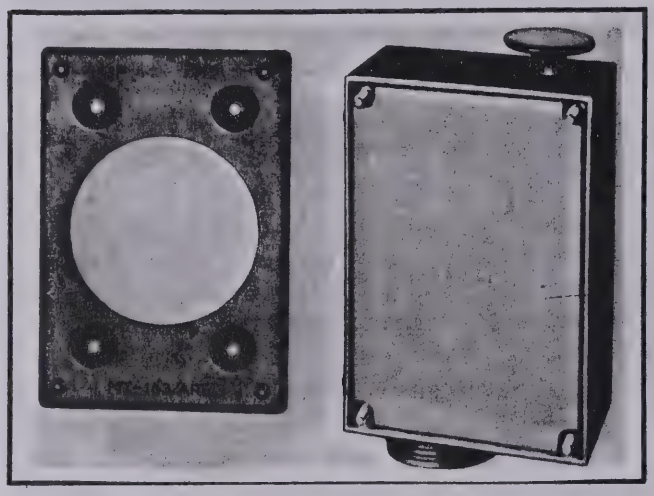


Figure 2-12—Control Unit C-87/ART-13 with Mounting Plate MT-163/ART-13 (Navy Type -23330)

d. REMOTE CONTROL UNIT. (See figure 2-12.) Locate the control unit so that the controls are easily accessible to the operator. Mount it with the key upward leaving sufficient space for operation of the key.

(1) See figure 5-11 for outline dimensions, plug clearances and mounting hole positions and sizes.

(2) To mount the control unit on the mounting plate, place the unit on the mounting and tighten the four screws, one in each corner.

e. ANTENNA SHUNT CAPACITOR AND CONNECTING SWITCH.

(1) Locate the units as near the left end of the transmitter as possible. Place the switch between the unit and the transmitter in such a position that it can be operated during flight and so vibration will not cause it to close. The total length of leads from the transmitter to the capacitor shall not exceed 12 inches.

(2) See figure 5-12 for antenna shunt capacitor outline dimensions, bonding and position and size of mounting holes. See figure 5-13 for shunt capacitor connecting switch outline dimension.

f. ANTENNAS AND LEAD INS.—Antenna Equipment AN/ARA-4 has been designed for use with this transmitting equipment and its associated receiving equipment (Radio Receiving Set AN/ARR-11.) Use number 10 bare copper wire for connecting the transmitting antenna circuits inside the plane. Space the wires at least 1½ inches from any other metallic object. Use Beads IN-83 for additional protection where required.

4. INTER-UNIT CONNECTIONS.

a. Make up the inter-unit connections when installing the equipment. A drawing of a typical wiring diagram for Radio Transmitting Set AN/ART-13A is shown in figure 5-15. Typical wiring diagram for Radio Transmitting Set AN/ART-13 is shown in figure 5-16.

b. Cut the wires to the proper length for the installation involved.

c. Allow enough additional length for each cable so that the cable is not tight enough to interfere with the action of the shock mounts or to damage the connectors.

d. Figure 5-14 shows the dimensions of the plugs and outlines the method of connecting wires to the terminals.

e. Insert each plug into the corresponding socket in the equipment. Sockets are marked with the nomenclature of the proper plug.

f. Tighten the locking rings on all plugs and safety wire them in place.

5. INSPECTION AND TEST AFTER INSTALLATION.

a. Inspect the inter-connections to check them for conformity to the mock-up of the particular installation.

b. Check the knurled knobs on the front of the transmitter and dynamotor unit, the microphone selector switch under the chart and all connector plug locking rings for presence of safety wiring.

c. Inspect the antenna for proper security and tension.

d. Check the connections to the receiver, antenna ground and loading unit, making certain the spring connector terminals are making good contact with the wires.

e. Check all components for security of mounting.

f. Set up the frequencies to be used in the flight test on the channels desired according to the procedure given in paragraph 7, this section.

g. If low frequency equipment is installed, set up one frequency in the range 200 to 600 kilocycles and check for proper operation (see subparagraph 7*b*, (4) and 7*c* (3), this section).

h. Cycle each channel in turn and check each for proper operation on "CW" by closing the key and noting the plate current for each. Plate current with the meter switch is "P.A. PLATE" position should be in the area marked "CW." Do not leave the key down any longer than necessary.

i. Check "VOICE" and "MCW" operation on one frequency.

j. If remote control is included in the installation, cycle each channel from the control Unit with the "LOCAL-REMOTE" switch in the "REMOTE" position. Check "VOICE," "CW" and "MCW" operation on one channel from the remote control unit.

k. Turn on the receiver, make sure the "NORMAL-MONITOR" switch is in the "NORMAL" position, and listen in the liaison position of the jack box. The receiver hiss should be heard with the key up; the proper transmitter sidetone signal should be heard with the key down. Set the "OUTPUT" switch under the calibration chart on the position that gives the proper volume of sidetone signal when the transmitter is being keyed or modulated.

l. Tune the receiver for CW operation ("CW.OSC") switch in the "ON" position on one of the frequencies set up on the transmitter. Set "NORMAL-MONITOR" switch (normally on "LIAISON" junction box) in "MONITOR" position and turn the power level switch on the transmitter to "CALIBRATE" position. It should be possible to hear a beat note and to tune the beat note to zero by rotating the receiver dial. Return the power level switch to "OPERATE" and the "NORMAL MONITOR" switch to "NORMAL" position.

m. Establish communication with the ground station on each frequency to be used in the flight test.

6. FLIGHT TEST.

During the airplane test flight, establish communication with the ground station on both fixed and trailing wire antennas. The transmitter should be operated a minimum length of time on a regularly assigned test frequency.

7. ADJUSTMENTS.

WARNING

Operation of this equipment involves use of high voltages which are dangerous to life. Operating personnel must observe all safety regulations. Whenever the dynamotor is running, there is a potential of 1150 volts applied to the plate caps on top of the tubes.

a. USE OF CALIBRATION TABLES.

(1) The low-frequency and high-frequency oscillators are electron coupled with no provision made for crystal control of the frequency of either oscillator. Therefore, a crystal controlled frequency standard has been incorporated in the equipment to be used for the calibration of the variable frequency oscillators.

(2) Detailed oscillator calibration tables 5-1, 5-2, and 5-3 are included in section V for the crystal frequency indicator (MCW-CFI 8Q-2 Unit, shown in figure 2-4) delivered with Radio Transmitter T-47-A/ART-13. Tables for the old crystal frequency indicator MCW-CFI 8Q-1 Unit are 5-4, 5-5, and 5-6, as delivered with some Radio Transmitters T-47/ART-13 (Navy Type -52286) and illustrated in figure 2-5. Calibration instructions for Oscillator O-16/ART-13, when MCW-CFI 8Q-2 unit is installed in the transmitter, are included in paragraph 6A, section V.

Note

Be sure to use the correct table.

Calibrating frequency "check points" have been indicated in the calibration tables by printing them in heavy black type. When checking the calibration, it is necessary to use the check point which is numerically nearest to the transmission frequency that is to be used. In calibration tables 5-1 and 5-2 horizontal lines appear at intervals in the columns which serve to indicate the direction of the nearest check point. In these tables always use the check point which appears between the same horizontal dividing lines that the desired frequency appears between. In calibration tables 5-3, 5-4, 5-5, and 5-6 use the first check point (heavy type) that is encountered by either looking back to succeedingly lower frequencies or by looking ahead to succeedingly higher frequencies. A note is included at the bottom of each table which will aid in locating the correct check point.

(3) The check points are frequencies at which audio beat notes between the output of the low-frequency oscillator or the output of the high-frequency oscillator and the harmonics of the CFI unit may be heard. These "beat notes" are used for setting the dial and the movable indicator mark in adjusting for proper calibration of the oscillator. The frequencies in the tables are given in kilocycles with the control positions in columns opposite the frequency. The numbers in columns B or G may be considered as combination numbers. For control "G," the hundreds figures (the one or two figures in the third and fourth positions to the left of the decimal point as underlines in the following example 724.6 or 1536.4) are set on the revolution counter near the control and the rest of the number is set on the dial, estimating the figure to the right of the decimal and setting it between divisions on the dial. For control "B," the hundreds figures are set the same as for control "G," the two figures immediately to the left of the decimal point (724.6 or 1536.4) are set on the dial and the figure to the right of the decimal point (724.6 or 1546.4) is set by means of a vernier. To obtain the settings given in the columns under B and G (B and G represent both dial designation and calibration table column heading) rotate the control until the revolution counter indicates the proper number of full revolutions and the dial indicates the fraction of a revolution. For accuracy in setting control "B," a vernier scale has been provided. To use the vernier, set that part of the number to the left of

the decimal point opposite the zero line on the vernier scale. Then note the line on the vernier scale that corresponds to the figure to the right of the decimal point and rotate the dial slightly in a clockwise direction until that line of the vernier is lined up with the first line on the dial that approaches it. For example, opposite 3410 kc the reading under B in the table is 1114.1 To obtain this setting of control "B," rotate the dial until the revolution counter indicates that the control has been rotated 11 full revolutions from the zero setting (see fig. 2-13); then continue to rotate the control until 14 on the dial appears opposite the zero line on the vernier scale, note line 1 on the vernier scale and further rotate the dial until the first line (15) on the dial lines up with line 1 on the vernier.

Note

Radio Transmitter T-47/ART-13 (Type -52286) cannot be set up as accurately as Radio Transmitter T-47A/ART-13 since no vernier was supplied and calibration tables are not as accurate.

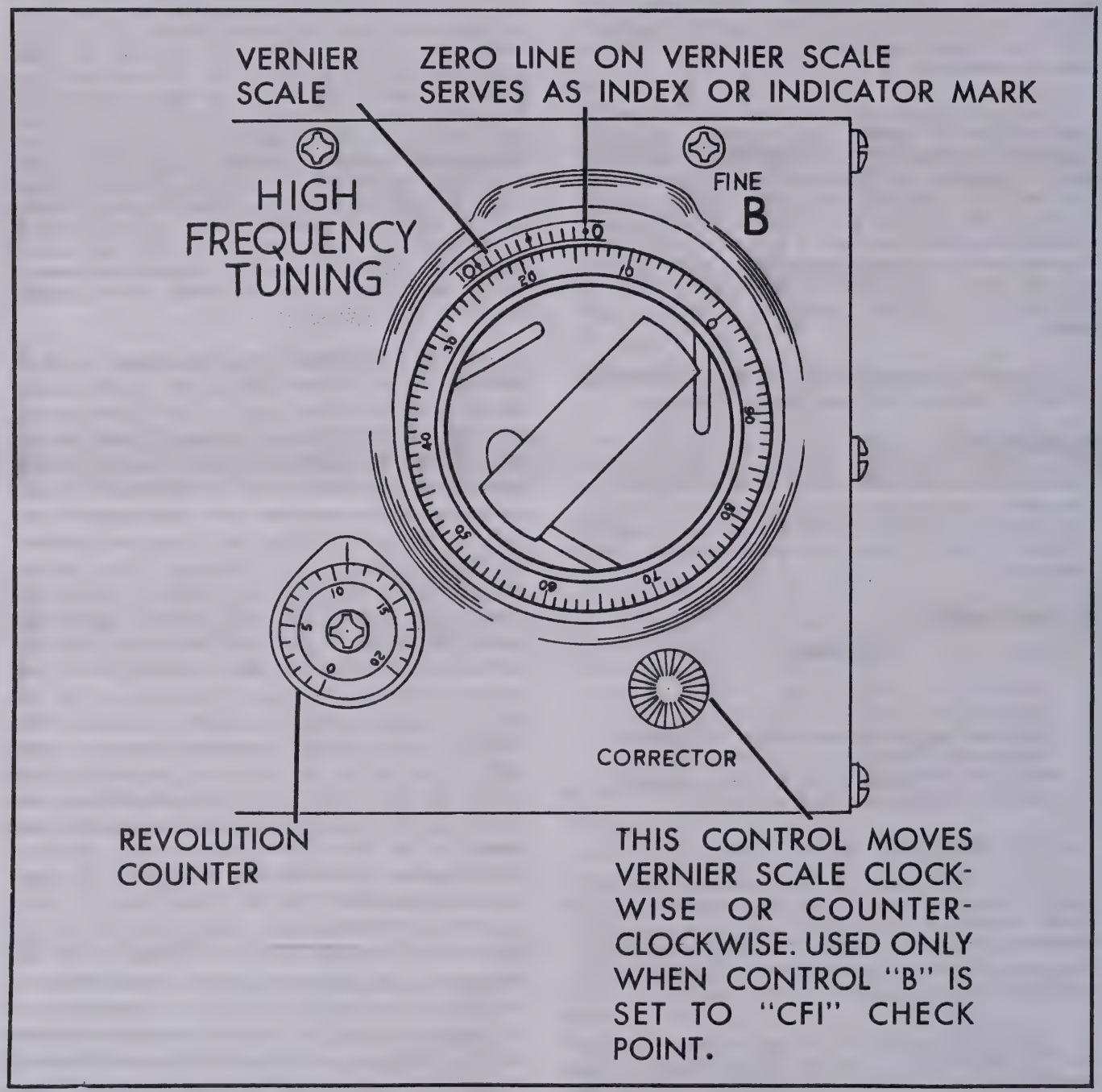

VERNIER SCALE
ZERO LINE ON VERNIER SCALE SERVES AS INDEX OR INDICATOR MARK
HIGH FREQUENCY TUNING
FINE
B
CORRECTOR
REVOLUTION COUNTER
THIS CONTROL MOVES VERNIER SCALE CLOCKWISE OR COUNTERCLOCKWISE. USED ONLY WHEN CONTROL "B" IS SET TO "CFI" CHECK POINT.

Figure 2 13—Illustration Showing Setting of Control "B" to 114.1 Per Example in the Text

(4) The transmitter can be set to frequencies between those given in the table by the following method:

(*a*) Find the two frequencies located on either side of the desired frequency.

(*b*) Find the difference between the dial settings of control "B" or "G" for these two frequencies.

(*c*) Multiply this difference by the decimal of a kilocycle in the desired frequency.

(*d*) Add this product to the dial setting for the lower frequency in subparagraph (*a*) above.

EXAMPLE

It is desired to transmit on 3411.5 kilocycles.

	FREQ.	A	B	
	3410	3	1114.1	
Desired Frequency 3411.5	3411	3	1116.6	*Difference Between Dial Settings is 2.4*
	3412	3	1119.0	
	3413	3	1121.5	

SETTING FOR DESIRED FREQUENCY IS OBTAINED THUS:

Difference in dial setting	2.4	
		Multiply
Decimal in the desired frequency	x .5	
Product	1.20	
Dial setting for lower frequency	1116.60	Add
Dial setting for desired freq.	1117.80	

b. PROCEDURES FOR SETTING THE CONTROLS (FOR MANUAL OR AUTOTUNE OPERATION.)

(1) GENERAL.—Following are the procedures for setting up the transmitter for manual or autotune operation. If manual operation is desired it is only necessary to set "CHANNEL" switch on "MANUAL" position and follow these instructions, except the locking bars should not be moved. Manual operation will not interfere with any of the channels set up for autotune operation if the locking bars are not loosened nor will setting up any channel in accordance with the following procedure interfere with any other channel previously set up. Channeling the autotune with the locking bars loose will completely eliminate the setting previously set up for the channel that was cycled and may cause settings for some or all of the other channels to shift.

(2) CW OPERATION INTO FIXED ANTENNA —VARIABLE FREQUENCY OSCILLATOR (VFO)— (2,000 to 18,100 Kilocycles).—The following procedure is to be used for setting up the transmitter for autotune operation on a desired frequency on any of the 10 high frequency channels.

(*a*) Place the antenna selector switch on the antenna loading unit on "FIXED ANT." position. ("FIXED" position when using Antenna Switching Unit SA-22/ART-13.) When no low frequency equipment is supplied in the installation, Switch SA-13/U is used.

(*b*) Make certain that the microphone, key, and throttle switch ("T.S.") jack circuits are open.

(*c*) Place "LOCAL-REMOTE" switch in "LOCAL" position and "VFO/XTAL" switch in "VFO" position.

(*d*) Place "EMISSION" switch in "VOICE" position.

(*e*) Check primary voltage by moving the meter switch to "BATTERY VOLTAGE" position. Usable primary voltage is indicated when the meter needle is within the light colored area under "BATTERY." A primary voltage of 28 volts will cause the meter needle to read at the top edge of this colored area. A primary voltage of 24 volts will cause the meter needle to read the lower edge of this colored area.

(*f*) Place "CHANNEL" switch in the position corresponding to the channel it is desired to set up. (If manual operation is desired, place "CHANNEL" switch in "MANUAL" position.) If the autotune system begins to run, allow it to complete the cycle of operation before proceeding. The red pilot light on the front of the transmitter will light when the autotune cycle is completed, and the transmitter will be ready for tuning adjustments or operation.

(*g*) Unlock all five controls by holding the dial and turning the locking bar ¼ turn in a counterclockwise direction. (If manual operation is being used, the locking bars should not be loosened.)

(*h*) Set control "C" on position 1. Check the position of the control against the indicator mark on the transmitter panel. The setting of this control is critical. The transmitter will not operate if control "C" is not set properly.

(*i*) Find the desired frequency in the calibration table and note the nearest crystal check point marked in heavy black type.

(*j*) Set control "A" to the position corresponding to the number in column A at this crystal check point. Check the position of the control against the indicator mark on the transmitter panel. The setting of this control is critical. The transmitter will not operate if control "A" is not set properly.

(*k*) Set control "B" to the position corresponding to the number in column B at this crystal check point.

(*l*) Set the power level switch to "CALIBRATE" position and listen in the sidetone circuit for a beat note while rotating control "B" back and forth about the position given for the crystal check point. Set con-

trol "B" on the position which gives zero beat and turn the power level switch to "TUNE" position.

(m) Set the venier scale or single index mark by means of the "CORRECTOR" knob near control "B" to the reading of control "B" found in column B at this crystal point.

(n) Refer to the calibration table and obtain the correct setting of control "B" for the desired operating frequency.

Note

Be sure to use the correct tables. For radio transmitters with the MCW-CFI 8Q-2 Unit installed use tables 5-1, 5-2, and 5-3; for radio transmitters with the MCW-CFI 8Q-1 Unit installed use tables 5-4, 5-5, and 5-6. (When the MCW-CFI 8Q-2 Unit is installed in the transmitter and Oscillator O-16/ART-13 is used, refer to par. 6A, section V for instructions for calibrating the oscillator.)

(o) Set control "B" to the reading obtained above.

(p) Lock control "A" by first noting its reading, rotating dial counterclockwise one-quarter turn, or against the stop if the stop is within one-quarter turn, and then rotating it clockwise to, but not past the reading on which it had been set. Hold the knob and turn the locking bar clockwise until it is tight with a firm but not heavy pressure. Repeat this procedure for control "B." Further pressure on either control in a clockwise direction should not cause the dial to move beyond the original setting. If it does, unlock and repeat the locking procedure, making certain the original dial settings are used. (If manual operation is being used, the locking bars should not be bothered.

(q) Place "EMISSION" switch on "CW" position.

(r) Check the grid drive to the final amplifier by placing the meter switch on "P.A.GRID" position, closing "TEST" switch, and noting the reading on the meter. It should read in, or slightly above, the light colored area marked "P.A.GRID." If it does not, operation is not normal. Control "A" may not have been positioned accurately. Check the trouble before proceeding. See "Note" in subparagraph *(bb)* following.

(s) Place the meter switch on "P.A.PLATE" position.

(t) Place control "D" on zero.

(u) Hold "TEST" switch closed and rotate control "E" throughout its range, seeking a plate current dip indicating resonance of the circuit.

CAUTION

Do not move control "E" across the space between 100 and 200 or between 0 and 100 while "TEST" switch, microphone button, or key is closed. An internal switch will be damaged if this precaution is not followed.

(v) If no resonance dip is found, set control "C" on the next higher position and rotate control "E" again, seeking a dip in plate current.

(w) Repeat the instructions in subparagraph *(v)* above until the resonance dip is found or until control "C" is set on position 8 and resonance has not been found.

Note

If frequency of operation is below 3000 kilocycles see instructions in subparagraph *(jj)* following.

(x) If resonance was found on positions 1 to 7 inclusive on control "C", place the power level switch in "OPERATE" position.

(y) Load the power amplifier by increasing the reading on control "D" in steps, re-resonating with control "E" each time. When control "D" has been rotated throughout its range, set control "C" on the next higher position, control "D" on zero, and repeat. Continue this process until the resonance dip falls in the light colored area marked "CW" on the plate meter. Correct loading of the final amplifier tube, when a 28-volt primary voltage is used, is 100 on the plate meter. It may not be possible, in all cases to load the amplifier tube exactly to this value, but any value of loading which is in the light colored area marked "CW" will be satisfactory.

Note

If the resonance dip causes the plate current to fall to a very low value, control "C" may be set to the next higher position without moving control "D," always re-resonating with control "E" each time as before. Fine adjustment must still be made by means of control "D." On antennas more than 55 feet in length and on frequencies below 3000 kilocycles it may not be possible to load the final amplifier to the light area marked "CW" before control "E" reaches zero. If this happens, set control "E" on zero and resonate with control "D." This will give the best operation obtainable under these conditions.

(z) If resonance was not found before control "C" was set on position 8, leave control "C" on position 8, set control "E" on zero, and seek the resonance dip in plate current by rotating control "D" throughout the range of 0 to 100.

(aa) If resonance is not found, set control "C" on the next higher position, rotate control "D" again, seeking the resonance dip.

(bb) Repeat subparagraph *(aa)* above until resonance is found or until control "C" has been tried on position 13 without finding a resonance dip.

(*cc*) If the resonance dip was not found with control "C" on position 13, leave that control on position 13, place control "D" on 100, and seek the resonance dip with control "E."

(*dd*) When resonance is found, place the power level switch on "OPERATE" position.

(*ee*) Load the power amplifier by increasing the reading on control "E" in steps, re-resonating with control "D" each time until the resonance dip falls in the light colored area marked "CW" on the meter.

Note

On some types of antennas, and often with Control "C" on position 13, loading may decrease when control "E" is placed on a higher position. In that event, reverse the direction of movement of control "E".

(*ff*) After proper loading of the final amplifier tube has been found using any of the above procedures, lock control "C" by noting its reading, rotating the dial counterclockwise about one-quarter turn, and then rotating it clockwise to but not past the reading on which it had been set. Hold the knob and turn the locking bar clockwise, until tight, with a firm but not heavy pressure. Further pressure on the dial in a clockwise direction should not cause the dial to move beyond the original setting. If it does, unlock and repeat the locking procedure, making certain the original dial setting is used. Repeat this procedure with controls "D" and "E." (If manual operation is being used, the locking bars should not be bothered.)

(*gg*) Check tuning and locking by holding "TEST" switch closed while placing a small force on each dial in turn in the clockwise direction. If all dials are locked properly, no detuning will result. (Do not use this test when in "MANUAL" position.)

(*hh*) Repeat the above procedure for each high frequency autotune channel it is desired to set up on the transmitter.

Note

The "P.A.GRID" meter reading, with control "A" on position No. 7 is usually at the lower edge of the light colored area marked "CW." It is permissible for the grid meter reading for this particular setting (control "A" on No. 7) to be 50 on the meter scale and still be satisfactory. A lower meter reading is not satisfactory, and the transmitter should be replaced with a serviceable transmitter if resetting of control "A" does not correct the difficulty.

(*ii*) When operating in the 2000 to 3000 kilocycle range into a fixed antenna, care must be exercised to avoid operation on a harmonic of the desired frequency. This will be avoided in most cases by following the outlined procedure for tuning adjustment into a fixed antenna. However, for frequencies between 2000 and 3000 kilocycles on antennas shorter than 50 feet, the antenna may be too short for the tuning elements in the transmitter to resonate at the fundamental frequency. Therefore, the first resonance indicated by the tuning adjustment procedure may be a harmonic of the desired frequency. To determine whether this is tuned, follow the tuning procedure outlined in subparagraph (*jj*) below.

(*jj*) For operation into short antennas (less than 50 feet) at frequencies between 2000 kilocycles and 3000 kilocycles it may be necessary to connect the antenna shunt capacitor to the "COND" post on the transmitter. This is accomplished by throwing the knife switch so the capacitor is connected to the transmitter. The following table may be used as a guide to determine whether or not use of the capacitor will be necessary and, if used, how many sections are required for various frequencies and lengths of antenna.

Length of Antenna (in feet)	*Frequency Range (in kilocycles)*	*Antenna Shunt Capacitor number of Sections Necessary*
60 to 65.....	2000 to 18100....	none
53 to 60.....	2000 to 2100.....	one
53 to 60.....	2100 to 18100....	none
45 to 53.....	2000 to 2100.....	two
45 to 53.....	2100 to 2200.....	one
45 to 53.....	2200 to 18100....	none
36 to 45.....	2000 to 2100.....	three
36 to 45.....	2100 to 2200.....	two
36 to 45.....	2200 to 2400.....	one
36 to 45.....	2400 to 18100....	none
27 to 36.....	2100 to 2200.....	three
27 to 36.....	2200 to 2400.....	two
27 to 36.....	2400 to 2700.....	one
27 to 36.....	2700 to 18100....	none
20 to 27.....	2200 to 2400.....	three
20 to 27.....	2400 to 2700.....	two
20 to 27.....	2700 to 3000.....	one
20 to 27.....	3000 to 18100....	none

To determine the length of the antenna, measure the total length of wire from the antenna terminal of the transmitter to the extreme end of the antenna (including the length of the lead inside the airplane.) If the antenna is a "T," disregard the length of wire in the shorter branch at the top of the "T," or, if the two branches are equal, include the length of only one of them. The tuning procedure for the transmitter, when using the shunt capacitor, is identical to the procedure without the shunt capacitor. *The use of the antenna*

shunt capacitor reduces the power output from the transmitter when used on frequencies higher than those which require its use. For this reason, it should not be used except when necessary and only on those channels which require it. This cannot be done if the transmitter is to be operated from a remote position, since no provisions have been made to automatically switch the shunt capacitor in or out. In this case the capacitor should be used only if it is desired to set a channel in the frequency range wherein the antenna cannot be resonated by the tuning elements in the transmitter itself, and it must be left in for all channels regardless of the reduction of power. Only the capacity necessary to tune the lowest frequency used should be connected. This can be done by connecting one, two, or three of the capacitors in parallel, according to the amount of capacity needed. Use the smallest number possible. To determine the lowest frequency that can be tuned with a given number of capacitors for a particular antenna, proceed as follows:

1. Connect the circuit it is desired to check; that is, either no capacitor connected, one section connected, two sections connected, or three sections connected.

2. Place "LOCATE REMOTE" switch to "LOCAL" position.

3. Place "EMISSION" switch on "VOICE" position.

4. Place "CHANNEL" switch on "MANUAL" position.

5. Place the meter switch on "P.A.PLATE" position.

6. When the autotune motor stops and the pilot light comes on, set control "A" on position 2 and control "B" on 2000.

7. Tune the load the power amplifier according to instructions contained in subparagraph 7*b*(2)(*q*) through (*y*).

8. Attempt to repeat the above tuning and loading procedure with each of the following combinations of settings in turn.

Control A	*Control B*
2	1500
2	1000
2	500
1	1500
1	1000
1	500
1	100

The setting of control "E" for each successive trial will be lower than for the preceding trial. If one of the above combinations of controls "A" and "B" cannot be tuned without going to a higher setting of control "C" than for the preceding combination, place control "C" on position 1, control "D" on zero, and control "E" on zero. Then rotate control B toward a higher reading, while holding "TEST" switch closed, until the plate current shows a resonance dip. Turn the transmitter off and look up the frequency in the calibration table corresponding to the combination of controls "A" and "B" found by this process. This installation of the transmitter, with sections of the antenna shunt capacitor (if used), with this length of fixed antenna wire in this type of airplane, cannot be tuned to any frequency below that obtained by this process. It may appear that proper operation is obtained by continuing the tuning procedure to higher positions of control "C," but this results in operation on a harmonic of the desired frequency and will result in complete lack of communication.

(3) CW OPERATION INTO TRAILING ANTENNA—VARIABLE FREQUENCY OSCILLATOR (VFO)—(2,000 to 18,100 Kilocycles)

(*a*) Set control "A" and "B" on the desired frequency by following instructions in paragraphs 7*b*(2)-(*b*) through (*s*).

(*b*) Connect the "ANT." post on the transmitter to ground with a lead as short as possible.

(*c*) Place control "D" on zero.

(*d*) Hold "TEST" switch closed and rotate control "E" throughout its range, seeking a plate current dip indicating resonance of the circuit.

(*e*) If no resonance dip is found, set control "C" on the next higher position and rotate control "E" again, seeking a dip in plate current.

(*f*) Repeat the instructions in paragraph (*e*) above until the resonance dip is found or until control "C" is set on position 8.

(*g*) If resonance was not found before control "C" was set on position 8, leave control "C" on position 8, set control "E" on zero, and seek the resonance dip in plate current by rotating control "D" throughout the range of 0 to 100.

(*h*) If resonance is not found, set control "C" on the next higher position, rotate control "D" again, seeking the resonance dip.

(*i*) Repeat paragraph (*h*) above until resonance is found or until control "C" has been tried on position 13 without finding a resonance dip.

(*j*) If the resonance dip was not found with control "C" on position 13, leave that control on position 13, place control "D" on 100, and seek the resonance dip with control "E." Do not attempt to load the transmitter.

Note

The above procedure may be accomplished on the ground and controls "C," "D," and "E" locked in the positions found for each frequency on which trailing wire operation is desired. Then during flight, it will be necessary to channel the autotune into the channel on which it is desired to operate: unlock controls "C," "D," and "E" and continue with the procedure that follows. Be sure "EMISSION" switch is on "CW," power level switch in on "TUNE" and meter switch is on "P.A.PLATE."

(*k*) When resonance is obtained, release the "TEST" key and remove the connection between the "ANT." post and ground and make certain the proper wire is fastened to that post.

(*l*) Let out the trailing wire to a counter reading 10 higher than that shown in the following table of approximate antenna lengths for the desired frequency.

(*m*) Hold the "TEST" switch closed and reel the wire in while watching the plate current meter for a resonance dip.

(*n*) If no dip is found, let the wire out to a reading 20 higher than that indicated in the table and repeat the reeling-in procedure.

COUNTER READING

KC	*1/4 Wave*	*3/4 Wave*	*5/4 Wave*
2000	101		
3000	61		
4000	46	150	
5000	38	118	
6000		90	
7000		70	
8000		60	
9000		48	93
10000		41	76
12000			55
14000			44
16000			37
18000			34

(*o*) When resonance is found, adjust the length of the wire to correspond to minimum plate current and set power level switch on "OPERATE" position.

(*p*) If resonance was found with control "C" on positions 1 to 7 inclusive, load the power amplifier by increasing the reading on control "D" in steps, re-resonating with control "E" each time. When control "D" has been rotated throughout its range, set control "C" on the next higher position, control "D" on zero, and repeat. Continue this process until the resonance dip falls in the light shaded area marked "CW" on the plate meter.

Note

If the resonance dip causes the plate current to fall to a very low value, control "C" may be set to the next higher position without moving control "D," always re-resonating with control "E" each time as before. Fine adjustment must still be made by means of control "D."

(*q*) If resonance was found with control "C" on positions 8 to 13 inclusive, load the power amplifier by increasing the reading on control "E" in steps, re-resonating with control "D" each time until the resonance dip falls in the light colored area marked "CW" on the meter.

(*r*) Lock controls "C," "D," and "E." (If manual operation is being used, the locking bars should not be loosened.)

Note

This channel may be used on trailing wire again without unlocking the dials by cycling the autotune into the channel, placing the power level switch on "TUNE" position, adjusting the antenna length to the position corresponding to minimum plate current if frequency is below 10,000 kilocycles and to maximum antenna current if frequency is above 10,000 kilocycles and returning the power level switch to "OPERATE" position. Be sure to use the same number of quarter wave lengths as in tuning up.

(*s*) Trailing wire operation will increase the range of the equipment considerably in the frequency range 2000 to 6000 kilocycles, some in the frequency range 6000 to 10,000 kilocycles, but will not increase it appreciably for frequencies above 10,000 kilocycles.

(3A) CW OPERATION INTO FIXED OR TRAILING ANTENNA—CRYSTAL OSCILLATOR (2,000 to 18,000 Kilocycles)

(*a*) With the CDA-T in use, replacing the low frequency unit (either O-16/ART-13 or O-17/ART-13A), the transmitter installation and operation will remain basically the same as outlined in paragraphs 7 *a* and 7 *b* of Section II. The few differences are as follows:

1. The "VFO/XTAL" switch on the CDA-T unit must be turned to "XTAL".

2. The "A-B" switch on the CDA-T must be operated to obtain a choice of two crystals on each of the 10 high frequency channels.

3. Meter readings will be lower than for VFO operation, but not excessively lower. The "P.A.GRID" setting should never go below "40".

4. When setting up the Autotone system, crystals must be chosen whose proper harmonic will fit into

the frequency range specified on "A" dial for each channel.

5. When using remote control, only 10 frequencies are available (depending on the setting of the "A-B" switch at the transmitter) unless the remote control unit has been modified to include an "A-B" switch.

6. While the calibration charts are not so essential as when operating with VFO, the setting of dial "B" will affect the proper frequency setting, even with crystal operation; and it is important that this "B" setting be accurate.

(4) CW OPERATION INTO FIXED OR TRAILING ANTENNA—VARIABLE FREQUENCY OSCILLATOR (200 to 1500 Kilocycles).

The following procedure is to be used for setting up the transmitter; for autotune or manual operation on a desired frequency in the low frequency channel.

(*a*) Place the antenna selector switch on the antenna loading unit (on Antenna Switching Unit SA-22/ART-13, when used) in the position which selects the desired antenna.

(*b*) Make certain that the microphone, key and throttle switch ("T.S.") jack circuits are open.

(*c*) Place "LOCAL-REMOTE" switch in "LO CAL" position.

(*d*) Place "EMISSION" switch in "VOICE" position.

(*e*) Place "CHANNEL" switch in "L. FREQ." position and wait until the autotune stops.

(*f*) Unlock controls "A" and "C." Place control "A" on position 13 and control "C" on position 8, and lock them in place. (If manual operation is being used, place control "A" on position 13 and control "C" on position 8 without unlocking them.)

Note

If the low frequency autotune mechanism should fail, it is only necessary to switch to "MANUAL" and set control "A" to position 13 and control "C" to position 8, since low frequency operation is only a switching procedure. It is possible to set the low frequency position on any of the 11 channels. It is only necessary to lock control "A" on position 13 and control "C" on position 8, on the channel it is desired to use as a substitute for the "L. FREQ." position.

(*g*) Find the desired frequency in the calibration table and note the nearest crystal point marked in heavy black type.

(*h*) Set control "F" to the position corresponding to the number in column F at the crystal check point.

(*i*) Unlock control "G" by turning the lock knob counterclockwise until loose. Then set control "G" to the position corresponding to the number in column G at the crystal check point.

(*j*) Set the power level switch to "CALIBRATE" position and listen in the sidetone circuit for a beat note while rotating control "G" back and forth about the position given for the crystal check point. Set control "G" on the position that gives zero beat and turn the power level switch to "TUNE" position.

(*k*) Set the movable indicating mark by means of the "CORRECTOR" knob near control "G" to the reading of the control "G" found in the column G at the crystal check point.

(*l*) Refer to the calibration table and obtain the correct setting of control "G" for the desired operating frequency and set control "G" to that reading. Lock the dial.

(*m*) Place "EMISSION" switch on "CW" position.

(*n*) Check the grid drive to the final amplifier by placing the meter switch on "P.A.GRID" position, closing "TEST" switch, and noting the reading on the meter. It should read in, or slightly above, the light colored area marked "P.A.GRID" on the meter. If it does not, check the positions of controls "A" and "C."

(*o*) Place the meter switch on "P.A.GRID" position.

IMPORTANT

Continue with steps (*p*) through (*y*) below when using Antenna Loading Unit CU-32/ART-13A. Continue with steps (*z*) through (*bb*) following when using Antenna Loading Coil CU-25/ART-13 (Antenna Loading Coil CU-26/ART-13) and Antenna Switching Unit SA-22/ART-13.

(*p*) Place control "P" on the Antenna Loading Unit on position 1.

(*q*) Place control "Q" on position 1.

(*r*) Unlock control "R" and place it on zero.

(*s*) Hold "TEST" switch closed and rotate "R" throughout its range, seeking a plate current dip indicating resonance of the circuit.

(*t*) If no resonance was found, place control "Q" on the next higher position, hold "TEST" switch closed, and rotate control "R" again, seeking the dip in plate current.

(*u*) Repeat paragraph (*t*) above until resonance is found or until control "Q" has been tried on all its positions.

(*v*) If no resonance was found in subparagraph (*u*) above, set control "P" on the next higher position, control "Q" on position 1 and repeat subparagraphs (*s*) (*t*) and (*u*) above.

(*w*) Repeat subparagraph (*v*) above until reson ance is found.

(*x*) When resonance is found, lock control "R" in the position giving minimum plate current.

(*y*) This completes the tuning procedure when using Antenna Loading Unit CU-32/ART-13A as there is no provision for exact loading of the transmitter in the frequency range 200 to 600 kilocycles. The plate current may read anywhere between 10 and 120 for normal operation.

Note

For operation in the 200 to 600 kilocycle range, use Antenna Loading Coil CU-25/ ART-13 with controls "K" and "L"; in the 600 to 1500 kilocycle range, use Antenna Loading Coil CU-26/ART-13 with controls "H" and "J."

(*z*) Place control "K" (or "H" as applicable) on position 1.

(*aa*) Turn the "LOCK" knob counterclockwise until loose on control "L" (or "J" as applicable).

(*bb*) Place the "EMISSION" selector switch on "CW" position.

(*cc*) Hold the "TEST" switch closed and rotate control "L" (or "J") throughout its range, seeking a plate current dip indicating resonance of the circuit. Be sure meter circuit selector switch is in "P.A. PLATE" position.

(*dd*) If no resonance was found, place control "K" (or "H") on the next higher position, hold the "TEST" switch closed, and rotate control "L" (or "J") again, seeking the dip in plate current.

(*ee*) Repeat paragraph (*dd*) above until resonance is found.

(*ff*) Adjust control "L" (or "J") to the position giving minimum plate current.

(*gg*) Place the "CALIBRATE-TUNE-OPERATE" switch in the "OPERATE" position.

(*hh*) This completes the tuning procedure, as there is no provision in the frequency range 200 to 1500 kilocycles for exact loading of the transmitter to the light colored area marked "CW" on the plate meter. The plate current may read anywhere from 10 to 110.

Note:

If the low-frequency autotune mechanism should fail, it is only necessary to switch to "MANUAL" and set control "A" to position 13 and control "C" to position 8. Since the low frequency operation is only a switching procedure, it is possible to set the low frequency position on any of the 11 channels. It is only necessary to lock control "A" on position 13 and control "C" on position 8 on the channel it is desired to use as a substitute for the "L. FREQ." position.

(*ii*) Note that the tuning reactance present in Antenna Loading Coil CU-25/ART-13 (200-600 kc) may not be sufficient to resonate all fixed wire antennas down to 200 kc. It will resonate a 200-foot trailing wire antenna over the frequency range of 200-600 kc. The tuning reactance present in Antenna Loading Coil CU-26/ART-13 may not be sufficient to resonate all fixed wire antennas down to 500 kc. It will resonate a 200-foot trailing wire antenna over the frequency range of 600-1100 kc and a 150-foot trailing wire antenna over the frequency range of 1100-1500 kc.

(*jj*) Be careful to avoid operation on a harmonic of the desired frequency. In the type of tuning network used, the antenna is a part of the plate tuning circuit. Therefore, if the antenna is too short, it will not be possible to tune the lower end of the frequency range. To determine the lowest frequency that it is possible to tune, proceed as follows:

1. Set the "EMISSION" switch to "VOICE," the "CHANNEL" switch to "L. FREQ.," the meter selector switch to "P.A.PLATE," and the antenna changeover switch to the "FIXED" position.

2. Set control "K" to position 1 and control "L" to zero.

3. Make certain that control "A" stops on position 13 and control "C" on position 8. If not, set and lock the autotune in those positions.

4. Set control "F" on position 1 and control "G" on zero.

5. Set the power level switch to "TUNE."

6. Close the "TEST" switch and rotate control "G" toward a higher reading, watching for a resonance dip in plate current.

7. If the resonance dip is not found before control "G" is rotated to its extreme position, set control "F" on position 2, control "G" to zero, and repeat closing the "TEST" switch and rotating control "G" towards a higher reading again.

8. Set control "G" on the position that corresponds to the minimum plate current as found by the above method and release the "TEST" switch.

9. Determine the frequency indicated by the readings on control "F" and "G". Installation of this length and type of fixed antenna cannot be tuned to any frequency below that obtained by this process. It may appear that proper operation is obtained by continuing the tuning procedure to higher positions of control "K," but this results in operation on a harmonic of the desired frequency and will cause complete lack of communication. This same procedure may be used for the smaller load coil by substituting control "H" for "K" and control "J" for "L."

(4A) CW OPERATION INTO FIXED OR TRAILING ANTENNA—CRYSTAL OSCILLATOR (300 to 500 Kilocycles).

(*a*) With the CDA-T in use, replacing the low frequency unit (either O-16/ART-13 or O-17/ART-13A), the transmitter loading operations will remain primarily the same as outlined in paragraphs 7 *a* and 7 *b* of Section II. The differences are as follows:

1. The "VFO/XTAL" Switch on the CDA-T Unit must be thrown to "XTAL".

2. Through either manual or autotune operation, the transmitter "A" dial must be set on position 13, and the "C" dial on position 8. (Dial "B" has no function when using any of the low frequency units).

3. The 4-position switch (S-803),on the CDA-T Unit must be rotated to select the desired frequency of the four crystal-controlled frequencies available. This change in low frequency is possible only at the transmitter, and remote control must accept the frequency for which this switch is set.

4. Calibration charts are not required when using the CDA-T low frequency oscillator, as it's output is directly coupled to the transmitter power amplifier tube.

5. Meter readings for low frequency crystal operation, as with high frequency crystal operation, will be lower than for VFO operation.

(5) VOICE OPERATION.

(*a*) Adjust the transmitter for CW operation and place "EMISSION" switch on "VOICE" position. No further tuning adjustments are necessary.

(*b*) Be sure the microphone selector switch under the tuning chart on the front panel of the transmitter is in the position corresponding to the type of microphone being used.

(*c*) Press the button on the microphone or in its cord and hold it depressed while speaking. Release it to listen.

Note:

When the meter switch is in "P.A.PLATE" position, the meter indicates the sum of the power amplifier and modulator plate currents and will, therefore, read slightly higher on "VOICE" than on "CW." With normal modulation the plate current meter will read in the red area above the portion marked "CW" and may hit the meter peg with heavy modulation during normal operation.

(6) MCW OPERATION.

(*a*) Adjust the transmitter for CW operation and place "EMISSION" switch on "MCW" position. No further adjustments are necessary.

(*b*) Key the transmitter for normal operation.

Note:

The normal meter reading on "MCW" when the meter switch is in "P.A.PLATE" position, key down, will be in, or slightly above, the light colored area marked "MCW."

(7) ADJUSTMENT OF SIDETONE LEVEL.

(*a*) Lift the chart on the front panel of the transmitter.

(*b*) Listen in the headphones while holding the "TEST" switch closed and adjust the "OUTPUT" control for proper volume of signal. Check the volume on each type of emission; "MCW," "CW," and "VOICE."

(8) USE OF TRANSMITTER CHART

After the transmitter has been set on the desired channels, enter the readings of controls "A", "B", "C", "D" and "E" on the chart on the transmitter. Make these entries after the autotune has been channeled into each channel set up, and after the operation has been checked. Show the "A", "B" and "VFO" frequencies set up on each high frequency channel. If VFO is used, set the vernier scale or single index mark for control "B" with the zero line of the vernier directly above the dial, and record the reading of the dial with the vernier scale in that position. This will enable the operator to check the settings even after the movable vernier scale has been adjusted to set up another channel. If the shunt capacitor is necessary on any of the frequencies set up, write the number of sections required, following the number of the channel. The four low operating frequencies are likewise entered on the chart. Record the settings of controls "P", "Q" and "R" on th Antenna Loading Unit CU-32/ART-13A, or "K" and "L" on Antenna Loading Coil CU-25/ART-13, and indicate whether for fixed or trailing antenna. To minimize tuning in the air, leave controls "P", "Q" and "R" on the positions for fixed antenna operation and record the positions for trailing antenna on the chart, or reverse the order if desired.

(9) PREPARATION FOR OPERATION.—The transmitter uses tubes which require at least 30 seconds to warm up before operation. If conditions permit, have the transmitter in readiness for operation by leaving the "EMISSION" switch in "VOICE" position during the entire flight. This is a "standby" condition and eliminates the 30 second delay waiting for the tubes to warm up.

c. SIMPLIFIED PROCEDURES FOR SETTING THE CONTROLS.

(1) GENERAL.—The following procedures are for setting the controls using the approximate dial settings following the calibration tables.

(2) SIMPLIFIED CW OPERATION INTO FIXED ANTENNA (2000 to 18,100 kilocycles).

(*a*) Follow instructions in paragraphs 7*b*(2) (*a*) through (*s*).

(*b*) Set the control "C," "D," and "E" to the positions indicated in the table of approximate dial settings for the desired frequency. Be sure to use the column under the correct length of antenna. (Table 5-7 in this manual.)

(*c*) If control "C" is on position 7 or below.

1. Hold "TEST" switch closed and adjust control "E" to the position at resonance indicated by the dip in plate current.

2. Place the power level switch on "OPERATE" position.

3. If the plate current meter reading is above the area marked "CW" move control "D" a few divisions lower and readjust control "E" for minimum plate current. Repeat until the plate current reading is in the area marked "CW." If the plate current meter reading is below the area marked "CW" move control "D" a few divisions higher and readjust control "E" for minimum plate current. Repeat until the plate current reading is in the area marked "CW." Do not leave the control on any position other than that at the resonance dip. Lock control "C," "D," and "E."

(*d*) If control "C" is on position 8 or above.

1. Hold "TEST" switch closed and adjust control "D" to the position at resonance indicated by the dip in plate current.

2. Place the power level switch on "OPERATE" position.

3. If the plate current meter reading is above the area marked "CW," move control "E" a few divisions lower and readjust the control "D" for minimum plate current. Repeat until the plate current reading is in the area marked "CW." If the plate current meter reading is below the area marked "CW," move control "E" a few divisions higher and readjust control "D" for minimum plate current. Repeat until the plate current reading is in the area marked "CW." Do not leave the controls on any position other than at the resonance dip. Lock control "C," "D" and "E."

(3) SIMPLIFIED CW OPERATION INTO FIXED OR TRAILING ANTENNA (200 to 600 kilocycles) WHEN USING ANTENNA LOADING UNIT CU-32/ART-13A.

(*a*) Follow instructions in paragraph 7 (4) (*a*) through (*o*).

(*b*) Set controls "P" and "Q" on the positions indicated in the table of approximate dial settings for the frequency below the desired frequency. Be sure to use the column under the correct length of antenna.

(*c*) Follow the instructions in the regular procedure starting with paragraph 7*b*(4)(*s*).

d. PROCEDURES FOR SETTING THE CONTROLS OF RADIO TRANSMITTING SET AN/ART-13B (MANUAL OR AUTOTUNE OPERATION).

(1) GENERAL.–Radio Transmitting Set AN/ART-13B employs both variable frequency oscillator (VFO) operation and crystal-controlled (XTAL) operation. When operated as a VFO transmitter, utilizing Oscillator O-17/ART-13A, procedures for setting all controls are exactly as outlined for Radio Transmitting Set AN/ART-13A in paragraph *b.* of this section. For VFO operation on the high frequency range, with the CDA-T Oscillator in use, the transmitter controls are set as outlined for the AN/ART-13A, with the addition of one operation; that is the setting of the "VFO-XTAL" switch, on the CDA-T panel, to "VFO".

Crystal-controlled operation is obtainable only with use of the CDA-T Oscillator unit, and its "VFO-XTAL" switch turned to "XTAL". "MANUAL" operation is not possible with crystal-controlled operation. All transmitter and loading coil adjustments for crystal-controlled operation (excepting the frequency controls "A" and "B") are performed the same as described in paragraph *b.* of this section. Crystal-controlled frequency adjustment procedures are as follows.

(2) FREQUENCY ADJUSTMENTS–CRYSTAL CONTROLLED OPERATION.–Since manual control is inoperative with crystal-controlled operation, ten high frequency and one low frequency channels are available with autotune selection. Through use of an "A-B" switch on the CDA-T panel, two frequencies are available on each of the ten high frequency "CHANNEL" switch positions. A 4-position switch, also on the CDA-T panel, permits selection of four low frequencies with the "CHANNEL" switch in the "L.–FREQ." position.

(3) HIGH FREQUENCY RANGE.–Utilizing the "A-B" switch, two frequency channels are available on each of the autotune "CHANNEL" switch positions, 1 through 10. Selection of frequencies with the 1670 to 18,000 kc range are limited only by the available crystals and the individual range of each setting of the transmitters "A" control. "CHANNEL" switch positions of the autotune mechanism are not restricted to any particular setting of the "A" control and several frequency outputs within a narrow frequency range are possible, providing crystals are available for each channel desired. The crystal frequency used, however, must be suitable for the frequency range of the chosen "A" control setting.

Note

For frequencies from 1,670 kc through 2,000 kc, place the "EXTENDED-NORMAL" switch in "EXTENDED" position. For frequencies from 2,000 kc through 18,000 kc, place the "EXTENDED-NORMAL" switch in "NORMAL" position.

(a) Place the antenna selector switch on the antenna loading unit on "FIXED ANT." position. Make certain that the microphone, key and throttle switch (T.S.) jack circuits are open.

(b) Place "LOCAL-REMOTE" switch in "LOCAL" position, the "VFO-XTAL" switch in "XTAL" position and the "A-B" switch in the "A" position. Turn the "EMISSION" switch to "VOICE".

(c) Check crystals for proper seating and frequency. Channel the autotune to position 1. When cycling has stopped, check the frequency range of the control "A" setting, to be sure it is suitable for the crystal employed. If not suitable, change either the crystal or retune control "A" to the proper frequency range setting. Lock this control. Unlock the other transmitter controls; set control "C" to position 1.

(d) Place "EMISSION" switch on "CW" position. Check the grid drive to the final amplifier by placing the meter switch on "P.A.GRID" position, closing the "TEST" switch, and noting the reading on the meter. If no reading, or a very low reading is observed, close the "TEST" switch, at the same time varying the "B" control setting. The grid drive indication will vary as the "B" control setting is changed. Adjust this setting for maximum grid drive reading.

(e) Set the remaining transmitter loading controls, as described in paragraph *b.* to obtain proper P.A. Plate dip indication, and maximum antenna current reading.

(f) Channel the autotune to channel 2, and when cycling starts, turn the "CHANNEL" switch back to position 1. Again check the grid drive and P.A. Plate readings, which should be approximately the same as previously obtained.

(g) Channel the autotune to each of the remaining nine high frequency channels and tune as outlined for channel 1.

(h) If two frequency outputs are desired for any one position of the "CHANNEL" switch, their frequencies should not be separated by more than 3%. The exact amount of separation possible will be determined by the output frequency and the antenna characteristics into which the transmitter operates. Adjust the setting

of control "B" as outlined with the "A-B" switch on "A". Record the setting of this control for maximum grid drive reading. Throw the "A-B" switch to "B" and determine the setting of control "B" for maximum grid drive indication. Finally, set control "B" midway between the two settings obtained with maximum grid drive for the "A" and "B" crystals. Repeat this procedure for all channel switch positions for which two crystals are in use.

(4) LOW FREQUENCY RANGE.–Utilizing the 4-position selector switch, located on the CDA-T panel, four low frequency outputs within the range of 300 to 500 kc are possible. It will be noted that only three low frequency crystal sockets are provided, requiring the use of a dual crystal holder in one socket. Due to the physical limitations of this holder, its two crystals must be within the range of 400 to 500 kc. Remote control of low frequency operation is possible, only on one frequency, as the 4-position switch must be operated manually and its setting will determine the frequency obtained by the remote control operator.

(a) Place the antenna selector switch on the antenna loading unit in the fixed antenna position. Make certain that the microphone, key and throttle switch (T.S.) jack circuits are open. Place "LOCAL-REMOTE" switch in "LOCAL" position, the "EMISSION" switch in "VOICE" position, the "VFO-XTAL" switch in "XTAL" position, and the 4-position low frequency selector switch in position 1.

(b) Place "CHANNEL" switch in "L.FREQ." position and wait until the autotune stops. Control "A" should stop on position 13. If not in this position when cycling is complete, unlock control and set to 13. Set control "C" to position 8. (Control "B" is not required for low frequency crystal operation.)

(c) Place the meter switch on "P.A.GRID"; the "EMISSION" switch on "CW", and check for grid drive by closing the "TEST" switch and noting the meter reading. P.A.GRID meter readings will be lower than those obtained for the high frequency ranges.

(d) Adjust the variable choke, L-803, located at the top rear corner of the CDA-T unit, to obtain maximum grid drive indication.

(e) Turn the 4-position switch to the remaining three positions, and check for grid drive. Adjust the variable choke, as required, to obtain maximum grid drive reading for each switch position. This choke setting will vary slightly for each of the low frequency output frequencies, and should finally be set to obtain sufficient grid drive with all crystals employed.

(f) Set all other transmitter and loading coil adjustments as outlined in paragraph *b.* (4) *(o)* through *(y)* of this section, to obtain proper P.A. Plate dip indication and maximum antenna current reading. When more than one low frequency crystal is employed, optimum transmitter performance on any one frequency requires readjustment of the variable choke (for grid drive peaking) and the transmitter loading controls, with a resultant lowering of output at the remaining low frequency channels.

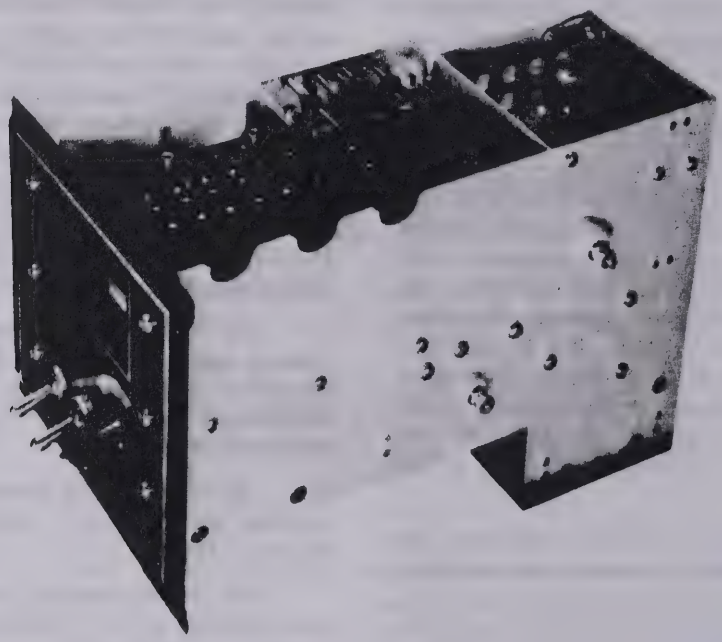


Figure 2-14–Crystal Controlled Oscillator Unit (CDA-T) – Front Side View

SECTION III
OPERATION

CAUTION

NO transmissions will be made on emergency (distress) HF Channels except for emergency purposes. For testing, demonstration or drill purposes, radio equipment will be operated into a non-radiating dummy load instead of an Antenna to prevent transmissions of false distress signals.

1. STARTING AND STOPPING.

a. TO START.—Turn "EMISSION" switch to "VOICE" position.

b. TO STOP.—Turn "EMISSION" switch to "OFF" position.

2. OPERATION DURING NORMAL USE.

a. Check "LOCAL-REMOTE" switch on the transmitter panel to make sure it is in the proper position according to whether operation is desired from the transmitter panel or from the remote control unit. If the CDA-T Crystal Oscillator is installed in the transmitter, check the "VFO/XTAL", "A-B" and 4-position low frequency switches to see that each is set according to the frequency and type of operation desired.

b. Place the emission switch on "VOICE" if the equipment is turned off or leave it on "VOICE," "CW," or "MCW" if equipment is already on and place "CHANNEL" switch on the position corresponding to the frequency on which transmission is desired. This may be found on the chart on the front panel of the transmitter. If there is a number (1, 2 or 3) after the channel number on the chart and in the same box with it, make sure that the number of sections of the shunt capacitor are connected and that Switch SA-46/ART-13A is closed.

c. When red pilot light comes on (it will take about 25 seconds for the autotune to seek the proper position), place the emission switch on the position corresponding to the type of emission desired; "VOICE," "CW" or "MCW." If operation is in the range 200 to 1500 kc, check to make sure that the proper frequency is set up on controls "F" and "G" and that the antenna circuit is in resonance before attempting operation.

d. Operate the transmitter with the microphone and its associated switch if "VOICE" operation is desired or with the key if "CW" or "MCW" is desired.

CAUTION

Under no circumstances should the transmitter be actually operating (key down or microphone switch closed) when the emission switch is being operated. Such operation, especially at high altitudes, can cause an arc to occur and damage the contacts of relays. Never leave the Autotune controls in any position other than against the stops in a clockwise direction. The mechanism always leaves them in the proper position and they should not be tampered with after cycling. Proper positioning may be checked by applying a firm but not heavy force to each control in a clockwise direction until the control strikes the stop.

3. DEFENSE AGAINST RADIO JAMMING.

a. GENERAL.—Jamming is the intentional generation by the enemy of radio signals designed to make friendly signals unreadable and to surprise and confuse the radio operators. The various types of jamming are described in section 5, paragraph 4.

b. PROCEDURE.—If bad interference is received and jamming is suspected, proceed as follows:

(1) Remove the antenna from the binding post of the receiver. If the noise level drops appreciably, the interference is coming from outside the receiver. If the noise does not diminish there is something wrong with the receiver.

(2) Tune the receiver several hundred kilocycles each side of the desired signal. If there is no change in intensity of the interference something close at hand is the cause. If the interference extends only over a short frequency band it is probably jamming.

(3) *Report jamming immediately to the commanding officer.*

(4) Use a crystal filter when available. Tune the receiver slowly back and forth across the desired signal to find the position where the signal is the clearest.

(5) Use a noise limiter when available. If no limiter is available turn the receiver gain up as high as it will go. To make this less hard on the ears put a handkerchief between the ears and headphones or just turn the headphones around so they are facing away from the ears.

(6) Change the BFO setting when working with CW. This will often put the message on one audio tone and the jamming on the other. With some types of jamming the signal can be heard better with the BFO cut off. Also try turning the gain control to a very low level.

(7) Change to an alternate frequency and call sign if the primary frequency is badly jammed. Tune up quickly and accurately using a dummy antenna if available. If not, tune up at reduced power.

(8) Generally CW is the most difficult to jam. Tone telegraph should also be tried. When using radiophone use the phonetic alphabet and speak each word twice.

(9) Beware of fake messages slipped into the jamming by the enemy. In case of doubt authenticate. Don't allow the enemy to distract attention with conversation.

(10) Do not shut down. That is exactly what the enemy wants to happen and it would let him know that the jamming is effective. Practice, concentration, and persistence will enable an operator to work through jamming many times stronger than the desired signal.

SECTION IV

EMERGENCY OPERATION AND REPAIR

1. EMERGENCY TROUBLE-SHOOTING (IN FLIGHT). The information presented here is intended to assist the technically trained operator to rapidly locate a source of trouble and make emergency repairs to the equipment while in flight. Use of the following chart, showing symptoms, causes and emergency remedies, for troubles that are most frequent causes of transmitter failure, should simplify and expedite the location and correction of the fault. It should be noted that this chart is intended for use only while in flight since it does not include information on troubles that require more involved repairs or parts replacement that cannot be accomplished in flight. Complete and detailed trouble-shooting may be accomplished, after the airplane has returned to its base, by using similar but more detailed trouble-shooting charts in section V of the maintenance handbook. See Figure 2-1 for tube placement.

Symptoms	*Probable Cause*	*Emergency Remedy*
1. Autotune does not run and tubes do not light.	1a. Open circuit breaker.	1a. Check circuit breakers in 28 volt supply lines to equipment.
	1b. Open overload relay on dynamotor unit.	1b. Press "TRANS. RESET" button on front of dynamotor unit.
2. Dynamotor does not start but Autotune runs and tubes light.	2a. Open overload relay on dynamotor.	2a. Press "DYNA.-RESET" button on front of dynamotor unit.
	2b. Interlock switch does not close.	2b. Short terminals of contact switch.
3. No R-F output on any frequency. Autotune runs, tubes light, and dynamotor starts.	3a. Control "C" is incorrectly set.	3a. Unlock the dial and rotate it back and forth through a small range while holding "TEST" switch closed. If R-F output is obtained, lock control near proper number so that transmitter will operate even if dial is not set exactly on the indicated position.
	3b. Blown fuse on dynamotor.	3b. Check fuse in holder labelled "400V." If blown, spare fuse is located in adjacent holder labelled "SPARE."
	3c. Vacuum switch failure (glass is cracked or arcing occurs inside the switch).	3c. Turn off equipment. Remove wire from the "ANT" post and connect it to the "COND." post. Add wire from "RECEIVER" post on transmitter to antenna (either fixed or trailing wire) that is not being used for transmission. Be sure trailing wire is reeled out. This operation may damage receiver if wire now connected to receiver antenna "A" post is not disconnected during the transmission period. It is recommended that this wire be disconnected during transmissions.

Symptoms	*Probable Cause*	*Emergency Remedy*
	3d. Antenna Loading Unit failure.	3d. Connect "ANT" post on transmitter directly to antenna lead-in. This will provide high frequency operation only.
	3e. "CALIBRATE - TUNE - OPERATE" switch set incorrectly.	3e. Be sure this switch is set to "OPERATE" position.
	3f. Faulty tube. Tubes V-104, V-103, V-102, V-101, V-801, V-802 or V-2601 are most likely offenders.	3f. Check tubes by replacement. Instructions for removing and replacing tubes are given in paragraphs 2, following this chart.
4. No R-f output on "L.FREQ." (200-600 kilocycles) range only. Other ranges are OK.	4a. Control "A" not set correctly.	4a. Be sure control "AW" is set exactly to position 13 ("L.FREQ.").
	4b. Faulty tube in low frequency oscillator.	4b. Check tube by replacement.
	4c. Fault in Antenna Load Unit.	4c. Cannot be corrected in flight. Use high frequency channels only.
5. No R-f output in 6 to 18 megacycles frequency range. Other ranges are OK.	5a. Faulty tube.	5a. Check tubes 813, V-102, and V-103 by replacement.
6. No R-f output in 2 to 6 megacycles frequency range.	6a. Faulty tube.	6a. Check tubes V-101 (or V-801), V-102 and V-103 by replacement.
Equipment will not operate from Remote Control Unit.	7a. Failure of Remote Control Unit or cable.	7b. Place "LOCAL-REMOTE" switch on transmitter panel in "LOCAL" position and operate equipment from its panel.
8. Autotune will not operate. Equipment is OK otherwise.	8a. Defect in "CHANNEL" switch.	8a. Turn switch to "MANUAL." If autotune operates, allow it to complete the cycle and then set all controls manually to their correct settings. If autotune still does not run, set 8b.
	8b. Defect in mechanism, and controls are "jammed."	8b. Loosen locking bars in all knobs and position each knob to correct setting.
9. Autotune operates but does not set all control knobs to their correct position.	9a. Faulty part in one or more of the autotune units.	9a. Try to turn the incorrectly set dial to correct position. If it will not turn, release the locking bar and then turn to correct setting.
10. No modulation on "MCW", but "VOICE" operation is OK.	10a. Faulty tube.	10a. Check tube V2203 by replacement (tube V-203 when MCW-CFI 8Q-1 unit is installed).
11. No modulation when "VOICE" operation is used.	11a. Faulty microphone plug or jack.	11a. Try connecting microphone to jack on remote control or transmitter panel.
	11b .Faulty tube.	11b. Check tubes V-201, V-202, V-203, V-105, and V-106 by replacement.
12. No sidetone but transmission is OK.	12a. Faulty tube.	12a. Check tube V-203 by replacement.
13. "BEAT NOTE" cannot be heard when crystal is attempting to calibrate.	13a. Defective CFI Unit.	13a. Replace crystal.
	13b. Faulty tube.	13b. Check tubes V-2201, V-2202, and V-2203, by replacement (tubes V-301, and V-302 when MCW-CFI 8Q-1 Unit is installed).

2. REPLACING TUBES.

a. Remove cover of transmitter by inserting coin or screwdriver in each hold-down screw and make a half turn counter-clockwise. Pry up cover.

WARNING

Be sure to turn off the entire equipment before replacing tubes. High voltage on caps at top of tubes is dangerous to life. Observe all safety precautions.

b. The position of each tube is shown in figure 2-1 in this handbook. All tubes with exception of V-2601 (low frequency oscillator) are visible and accessible when transmitter top cover is removed. Tube V-2601 can be reached by removing the cover of LFO unit (this unit is located directly behind control "G" and has perforated cover).

c. Tube clamps are used on some tubes to prevent tube from coming out of socket when vibration occurs. To open clamp, insert screwdriver and gently pry ope.. (see sketch in fig. 2-1). Clamps on tubes V-105 and V-106 are accessible through rear cover plate. Clamps on tubes V-102 and V-103 can best be reached from the top of transmitter. Obtain access to clamp on tube V-101 through side cover plate.

d. To replace tube V-104, orient the base pin with the slot in the hole above the socket and then press down firmly until tube pins are solidly engaged in the socket.

3. REPLACING FUSE.

The only fuse used in this equipment is located on the dynamotor unit chassis. The holder containing the fuse is labelled "400V." To remove the fuse, unscrew the holder. A spare fuse is located in the adjacent holder labelled "SPARE."

4. REPLACING DYNAMOTOR BRUSHES.

Remove end covers from dynamotor to obtain access to brushes. Replace brushes that are worn down to ¼" or less. When removing a brush that has been used, mark the upper side with the polarity and number (if applicable) that appears on the bracket near that brush so that it can be replaced in the same holder and in the same direction as before. New brushes may be installed in any holder with either side up, although it is preferable to place the brush code marking down so that the blank side of the brush will be used for marking when it is removed.

5. SUBSTITUTION OF TUBES WHEN REPLACEMENTS ARE NOT AVAILABLE.

The following tube substitutions can be made when a replacement tube of the correct type is not available.

a. LOW FREQUENCY OSCILLATOR
Replace with one of the Multiplier tubes. This will provide low frequency operation only.

b. ONE MULTIPLIER TUBE V-102 OR V-103.—Interchange with the low frequency oscillator tube. A tube with a good filament must be in the low frequency oscillator socket at all times. This will provide high frequency operation only.

c. TWO MULTIPLIER TUBES OR ONE MULTIPLIER TUBE AND THE LOW FREQUENCY OSCILLATOR TUBE.—Put the good tube in the first multiplier socket. Tubes with good filaments must be in the low frequency oscillator and the second multiplier sockets. This will provide operation in the frequency range 2000 to 6000 kilocycles.

d. SPEECH AMPLIFIER V-201.—Use "CW" operation. No sidetone signal will be available.

e. AUDIO DRIVER V-202.—Interchange it with the sidetone amplifier. There must be a tube with a good filament in the sidetone socket. This will provide normal operation with the exception of a sidetone signal.

f. MODULATOR V-105 OR V-106.—USE "CW" operation. The modulator tubes must have good filaments.

g. *DETECTOR AND MCW AUDIO OSCILLATOR V-2203.—Interchange it with the crystal oscillator tube. If there is a tube with a good filament in the crystal oscillator socket, all operation will be normal except the CFI will be inoperative. If the tube in the crystal oscillator socket does not have a good filament, only "VOICE" and "CW" operation are possible.

*e**. ANY COMBINATION INCLUDING ALL OF CRYSTAL OSCILLATOR V-2201, MIXER V-2202, DETECTOR AND MCW AUDIO OSCILLATOR V-2203, SIDETONE AMPLIFIER V-203.—There must be a good tube with a good filament in the sidetone amplifier socket. "VOICE" and "CW" operation are available.

*f**. ANY COMBINATION, INCLUDING ALL OF CRYSTAL OSCILLATOR V-2201, MIXER V-2202, DETECTOR AND MCW AUDIO OSCILLATOR V-2203, SPEECH AMPLIFIER V-201, DRIVER V202, SIDETONE AMPLIFIER V-203, MODULATORS V-105 AND V-106.—There must be tubes with good filaments in the modulator sockets. "CW" operation is available.

j. HIGH FREQUENCY OSCILLATOR V-101.—Interchange with the low frequency oscillator. The tube in the low frequency oscillator socket must have a good filament. It may be necessary to reset the frequency of operation since this interchange will cause the oscillator to shift from the original frequency. The tube must be replaced with the proper type as soon as possible. This interchange will provide high frequency operation only.

*These steps can be performed only when MCW-CFI 8Q-2 Unit is installed in transmitter.

6. REGULAR INSPECTIONS.

a. PREFLIGHT INSPECTION.—The radio transmitting equipment shall be given a rapid visual and operating inspection in accordance with the following:

(1) Inspect antenna for proper security and ten sion.

(2) Make a visual check for proper security of all set components.

(3) Turn on the liaison receiver.

(4) Place "EMISSION" switch on "VOICE" with "LOCAL-REMOTE" switch on "LOCAL" and antenna selector switch on "FIXED ANT." ("FIXED" when Antenna Switching Unit SA-22/ART-13 is used).

(5) Make sure the microphone selector switch is in the position corresponding to the type of microphone to be used.

(6) Be sure the meter switch is on "P.A.PLATE" and the power level switch is on "OPERATE."

(7) Place "CHANNEL" switch on a position corresponding to one of the frequencies to be used on the mission.

(8) When the cycle is completed, check the settings of controls "A," "B," "C," "D," and "E" against readings on the transmitter chart with the zero line of the vernier scale on control "B" previously set so that it is directly above the dial.

(9) Place "EMISSION" switch on "CW" and close "TEST" switch. The plate current should read in the area marked "CW."

(10) Place the meter switch on "P.A.GRID." The meter should read in the area marked "P.A.GRID." Release the "TEST" switch and place the meter switch on "P.A.PLATE."

(11) Place "EMISSION" switch on "MCW."

(12) Listen in the sidetone circuit and close the telegraph key. The receiver hiss should stop and the sidetone signal should be heard. The plate current should be in or near the area marked "MCW." Release "TEST" switch.

(13) Place "EMISSION" switch on "VOICE." Press the microphone button. The plate current should read about 20 or 30 higher than on "CW." Speak or whistle into the microphone. The plate current should read near the area marked "MCW" and may read full scale on loud signals.

(14) Check the control settings against the chart, the "P.A.GRID" and "P.A.PLATE" current on "CW" for each of the other channels it is desired to use on the mission. Connect the proper number of sections of the shunt capacitor for the channels requiring them as indicated on the chart. See section II, sub-paragraph 7*b*(8).

(15) If the transmitter is crystal controlled (equipped with a CDA-T Unit), switch to "XTAL" operation and check out one channel in the high frequency range as outlined in items (4) through (13) above. With the channel switch on low frequency, follow this same procedure to check out any of the 4 switch positions on the CDA-T Unit.

b. DAILY INSPECTION.—The radio transmitting equipment shall be given a thorough visual and operating inspection in accordance with the following:

(1) Inspect Antenna for proper security and tension. Check condition of shock links and antenna wire, cleaning if dirty and replacing if defective. Clean insulators and replace if cracked or chipped.

(2) Inspect the inter-unit connections for broken or damaged wires or cables and for high voltage wires that may be bent too near other objects.

(3) Check the knurled knobs on the front of the transmitter and dynamotor unit, the microphone selector switch under the chart, and all connector plug olcking rings for tiewire.

(4) Check the connection to the receiver, antenna, ground, loading unit, and transmitter making certain the spring connector terminals are making good with the wires.

(5) Check all set components for security of mounting.

(6) Turn on the liaison receiver.

(7) Place "EMISSION" switch on "VOICE" with "LOCAL-REMOTE" switch on "LOCAL" and antenna selector switch on "FIXED ANT." ("FIXED" when using Antenna Switching Unit SA-22/ART-13).

(8) Be sure the meter switch is on "P.A.PLATE" the power level switch is on "OPERATE."

(9) Place "CHANNEL" switch on a position corresponding to one of the frequencies that is set up on the autotune.

(10) When the cycle is completed, check the settings of controls "A," "B," "C," "D," and "E" against readings on the transmitter chart with the zero line of the vernier scale on control "B" previously set so that it is directly above the dial.

(11) Place "EMISSION" switch on "CW" and close "TEST" switch. The plate current should read in the area marked "CW."

NOTE

If the meter does not indicate a "P.A.PLATE" meter reading with the "CW" portion of the scale, some adjustment of the output loading may be necessary. Before attempting to readjust the output circuit for proper loading, check the battery voltage by rotating the meter switch to the "BATTERY VOLTAGE" position. Read the meter with the key depressed. If the meter reads within the light colored area under "BATTERY," the channel needs readjusting. If the meter reads above or below the colored area, the "P.A.PLATE" current may read above or below the area marked "CW" and the transmitter still be adjusted properly. No adjustment of the output controls should be attempted if the supply voltage does not read within the proper limits shown by the meter on the transmitter.

(12) Place the meter switch on "P.A.GRID." The meter should read in the area marked "P.A.GRID."

Release the "TEST" switch and place the meter switch on "P.A.PLATE."

(13) Place "EMISSION" switch on "MCW."

(14) Listen in the sidetone circuit and close "TEST" switch. The receiver hiss should stop and the sidetone signal should be heard. The plate current should be in or near the area marked "MCW." Release "TEST" switch.

(15) Place "EMISSION" switch on "VOICE." Press the microphone button. The plate current should read about 20 or 30 higher than on "CW." Speak or whistle into the microphone. The plate current should read near the area marked "MCW" and may bear full scale on loud signals.

(16) Check the control settings against the chart, the "P.A.GRID" and "P.A.PLATE" current on "CW" for each of the other channels set up. Connect the proper number of sections of the shunt capacitor for the channels requiring them as indicated on the chart. See section II, paragraph 7*b*(8).

(17) Check operation of the autotune on each of the channels not set up by cycling the autotune into each in turn and making sure the controls turn properly.

(18) If remote operation is provided in the installation, check operation of the autotune from it by cycling each channel in turn and checking the setting of controls against the transmitter chart for each channel set up and that the controls turn properly on all other channels. Check the key on "CW", and proper operation on "MCW" and "VOICE" from the remote control unit on one channel.

(19) Set "CHANNEL" switch on "L.FREQ." and let the autotune cycle.

(20) Make sure that control "A" stops on 13 and control "E" on 8. If they do not, lock them in those positions.

(21) If the antenna loading unit is supposed to be adjusted for operation into the fixed antenna on the frequency set up on the low frequency oscillator (see sec. II, par 7*b*(8)), unlock control "R" on the loading unit, close "TEST" switch, adjust control "R" to minimum plate current and release "TEST" switch. Lock control "R" in that position.

(22) Cycle the transmitter into one of the frequencies set up in the high frequency range. Tune the receiver for "CW" operation on that frequency. Set "NORMAL-MONITOR" switch on "MONITOR" position and turn the power level switch on the transmitter to "CALIBRATE" position. It should be possible to hear a beat note and to tune the beat note to zero by rotating the receiver dial. Return the power level switch to "OPERATE" and the "NORMAL-MONITOR" switch to "NORMAL" position.

(23) Place "CHANNEL" switch on "MANUAL" and let the autotune cycle. All controls should move freely. Set control "C" on position 1, control "A" on 2, control "B" on 1910. Set power level switch on "CALIBRATE" position and listen in the sidetone circuit. A beat note should be heard and it should be possible to tune it to zero by rotating control "B." Replace the power level switch on "OPERATE" position.

(24) Return "CHANNEL" switch to the position it was on originally and let the autotune cycle.

(25) If the transmitter is equipped with a CDA-T Crystal Oscillator Unit, switch to "XTAL" operation and follow the procedure as outlined in paragraph 6. *b*. (1) through (23). When checking the low frequency operation, dial "A" must be in position "13", and the 4-position switch on the CDA-T Unit must be rotated to obtain the four low frequencies. When checking the high frequencies, the "A-B" switch must be operated to obtain the 20 crystal frequencies.

(26) Turn the transmitter and the receiver off.

c. 100-HOUR INSPECTION.—The radio transmitting equipment shall be given a thorough and searching visual and operating inspection and a thorough cleaning in accordance with the following:

(1) Remove the transmitter from its mounting by cutting the tiewire on the locking knobs on the front and on the plug locking rings on the left end, removing the plugs and wires from the sockets and terminals on the left end, loosening the knurled locking knobs on the front of the transmitter, and sliding the transmitter forward off its mounting.

(2) Remove the cover and clean out all dust and dirt, particularly around isolantite bushings, stand-off, feed-through insulators, etc. Inspect for loose ends of wire, corrosion or other obvious defects.

(3) Inspect all relay contacts.

(4) Inspect in accordance with section II, paragraph 2*a*(1).

(5) Remove the dynamotor unit from its mounting by cutting the tiewire on the locking knobs and the plug locking rings on the front, removing the plugs from the front, loosening the knurled locking knobs and sliding the unit forward off its mounting.

(6) Remove the end covers and clean the interior of the machine.

(7) Remove and inspect the brushes. Replace those less than one-quarter inch long (see par. 4, this section). Be sure to mark the top of each brush removed with the polarity and number (if applicable) that appears on the end bracket near the respective brushes. When replacing brushes, be sure to put them back in the same holder and the same side up as removed.

(8) Inspect the commutators and smooth them with 00 sandpaper if they are rough.

(9) Replace the end covers and inspect in accordance with section II, par. 2*a*(2), and, in addition, inspect all relay contacts for pits and burns and all parts for corrosion. Clean the interior.

(10) Remove the antenna loading unit by cutting the tiewire on the four snapslides and the plus locking ring, removing the plugs and the wires to the terminals, loosening the snapslides, and lifting the unit out.

(11) Inspect in accordance with section II, par. 2*a*(5), and, in addition, clean the interior and inspect for corrosion.

(12) If the antenna shunt capacitor is a part of the installation, check it in accordance with section II, par. 2*a*(4) without removing it from the plane.

(13) If the remote control unit is a part of the installation, remove it by cutting the tiewire on the plug locking ring, removing the plug, and loosening the four screws in the corners of the unit.

(14) Inspect in accordance with section II, par. 2*a*(3), and, in addition, clean and inspect for corrosion.

(15) Reinstall all units in accordance with instructions given in section II, par. 3.

(16) Check in accordance with the Daily Inspection procedure outlined in pars. 6*b*(1) through (25) of this section.

7. REPLACEMENTS OF DEFECTIVE ITEMS. (*See paragraphs 2, 3 and 4 this section.*)

Try to localize trouble by replacing MCW-CFI unit, audio amplifier unit, or low frequency oscillator. If proper operation is obtained by replacing any of the above units, leave the good one in the transmitter and send the defective one for repair.

a. To remove the MCW-CFI unit, proceed as follows:

(1) Loosen the two screws of contrasting color, one at each end of the unit.

(2) Lift the unit out.

b. To remove the audio amplifier unit, proceed as follows:

(1) Loosen the two screws of contrasting color, one at each end of the unit.

(2) Unlock and remove the master oscillator tube (JAN-837).

(3) Lift the unit high enough to disengage the plug pins, then move it backward to clear the screw heads on the ends, and lift it out.

c. To remove the low frequency oscillator, proceed as follows:

(1) Remove the JAN-813 tube by removing the plate cap, inserting a small screwdriver under the tube base through one of the ventilating holes in the back, and exerting a light pressure upward while wiggling the tube gently from side to side. The tube lifts straight out: do not twist it.

(2) Remove the lead on the right side of the oscillator where it enters the unit.

(3) Remove the two screws from the back of the oscillator through the space left by removal of the JAN-813 tube.

(4) Remove the seven screws from around the edges of the oscillator's front panel and loosen the adjacent screws across the top of the autotune cover.

(5) Lift the oscillator straight up.

SECTION V
SUPPLEMENTARY DATA

1. TUBE COMPLEMENT.

a. For Radio Transmitter With Oscillator 0-17/ART-13A and MCW-CFI 8Q-2 Unit Installed.

Reference Symbol	*Stock No.*	*Type Designation*		*Function*
		JAN—	*VT—*	
V-101	2J837 or 2V101	JAN-837	VT-101	High Frequency Oscillator
V-102	2J1625 or 2V136	JAN-1625	VT-136	1st Frequency Multiplier
V-103	2J1625 or 2V136	JAN-1625	VT-136	2nd Frequency Multiplier
V-104	2J813 or 2V144	JAN-813	VT-144	Power Amplifier
V-105	2J811 or 2V217	JAN-811	VT-217	Modulator

Reference Symbol	*Stock No.*	*Type Designation*		*Function*
		JAN—	*VT—*	
V-106	2J811 or 2V217	JAN-811	VT-217	Modulator
V-201	2J12SJ7 or 2V162	JAN-12SJ7	VT-162	1st Audio Amplifier
V-202	2V6V6GT or 2V107-A	JAN-6V6GT	VT-107-A	Audio Driver
V-203	2V6V6GT or 2V107-A	JAN-6V6GT	VT-107-A	Sidetone Amplifier
V-2201	2J12SL7GT	*JAN-12SL7GT		1st Section is 200 kc. calibration oscillator. 2nd Section is Frequency Tripler
V-2202	2J12SA7 or 2V-161	*JAN-12SA7	VT-161	Detector
V-2203	2J12SL7GT	*JAN-12SL7GT		1st Section is Signal Detector. 2nd Section is MCW Audio Oscillator.
V-2601	2J1625 or 2V136	JAN-1625	VT-136	Low Frequency Oscillator.

*Types JAN-12SL7GT and JAN-12SL7 may be used interchangeably. Types JAN-12SA7 and JAN-12SA7GT may be used interchangeably.

b. For Radio Transmitter With Oscillator 0-16/ART-13 and MCW-CFI 8Q-1 Unit Installed.

V-101	2J837 or 2V101	JAN-837	VT-101	High Frequency Oscillator
V-102	2J1625 or 2V136	JAN-1625	VT-136	1st Frequency Multiplier
V-103	2J1625 or 2V136	JAN-1625	VT-136	2nd Frequency Multiplier
V-104	2J813 or 2V144	JAN-813	VT-144	Power Amplifier
V-105	2J811 or 2V127	JAN-811	VT-217	Modulator
V-106	2J811 or 2V217	JAN-811	VT-217	Modulator
V-201	2J12SJ7 or 2V162	JAN-12SJ7	VT-162	1st Audio Amplifier
V-202	2J6V6GT or 2V107-A	JAN-6V6GT	VT-107-A	Audio Driver
V-203	2J6V6GT or 2V107-A	JAN-6V6GT	VT-107-A	Sidetone Amplifier
V-301	2J12SJ7 or 2V162	JAN-12SJ7	VT-162	Calibration Oscillator
V-302	2J12SJ7 or 2V162	JAN-12SJ7	VT-162	MCW Oscillator
V-401	2J1625 or 2V136	JAN-1625	VT-136	Low Frequency Oscillator

c. For Radio Transmitter with Oscillator CDA-T and MCW-CFI 8Q-2 Unit Installed.

Reference Symbol	*Stock No.*	*Type Designation*		*Function*
		JAN—	*VT—*	
V-101	2J837 or 2V101	JAN-837	VT-101	High Frequency Oscillator
V-102	2J1625 or 2V136	JAN-1625	VT-136	1st Frequency Multiplier
V-103	2J1625 or 2V136	JAN-1625	VT-136	2nd Frequency Multiplier
V-104	2J813 or 2V144	JAN-813	VT-144	Power Amplifier

V-105	2J811 or 2V217	JAN-811	VT-217	Modulator
V-106	2J811 or 2V217	JAN-811	VT-217	Modulator
V-201	2J12SJ7 or 2V162	JAN-12SJ7	VT-162	1st Audio Amplifier
V-202	2V6V6GT or 2V107-A	JAN-6V6GT	VT-107-A	Audio Driver
V-203	2V6V6GT or 2V107-A	JAN-6V6GT	VT-107-A	Sidetone Amplifier
V-2201	2J12SL7GT	*JAN-12SL7GT		1st Section is 200 kc. calibration oscillator. 2nd Section is Frequency Tripler.
V-2202	2J12SA7 or 2V161	*JAN-12SA7	VT-161	Detector
V-2203	2J12SL7GT	*JAN-12SL7GT		1st Section is Signal Detector. 2nd Section is MCW Audio Oscillator.
V-801	2J6AQ5	JAN-6AQ5		Low Frequency Oscillator
V-802	2J1625 or 2V136	JAN-1625	VT-136	High Frequency Oscillator

*Types JAN-12SL7GT and JAN-12SL7 may be used interchangeably. Types JAN-12SA7 and JAN-12SA7GT may be used interchangeably.

2. FUSE COMPLEMENT.

Type No.	*Stock No.*	*Current Rating*	*Location*	
			Active Fuse	*Spare Fuse*
Aircraft type	8800-337360	1 amp.	Dynamotor "400V"	Dynamotor "SPARE"

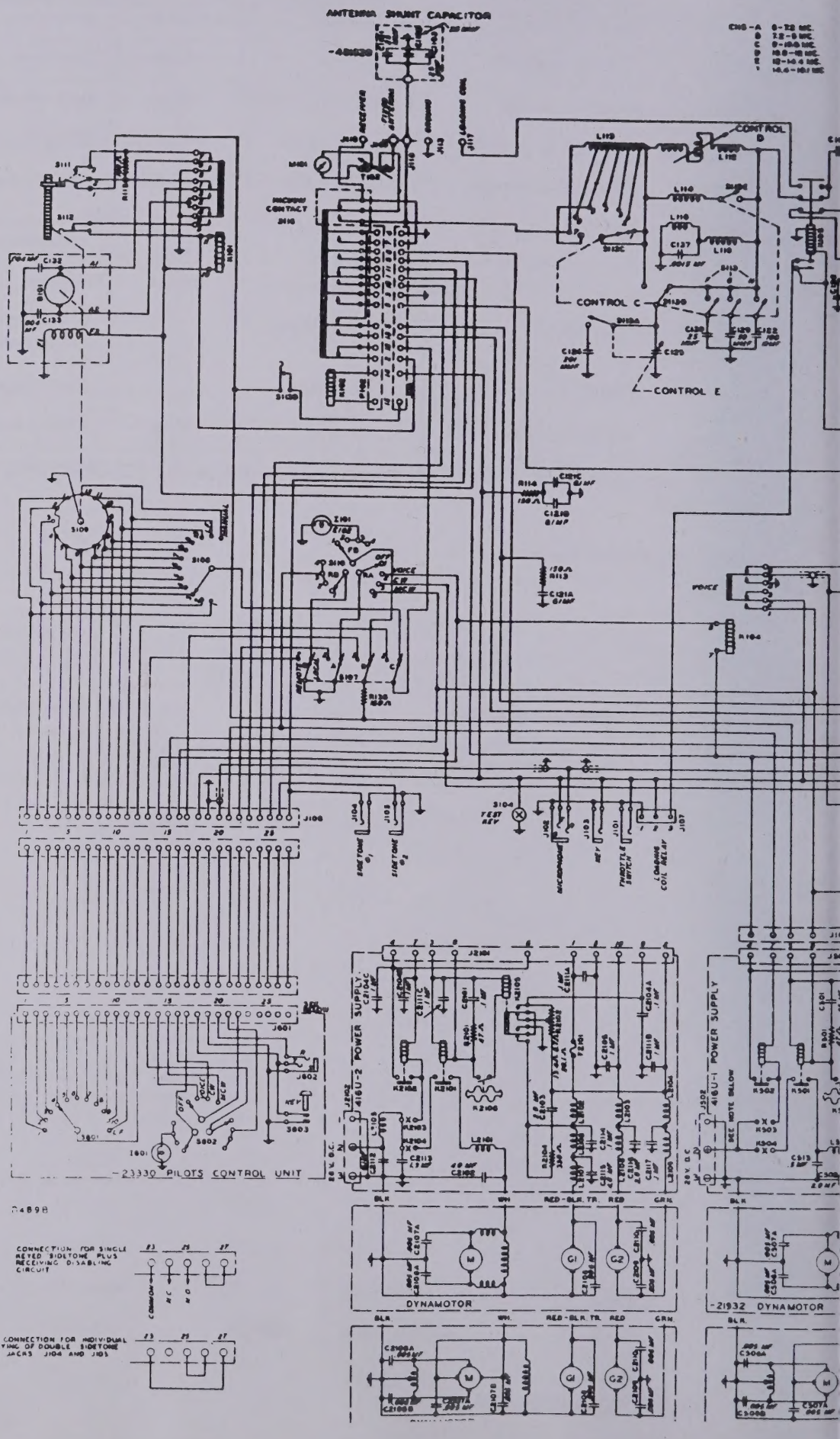
3. PILOT LAMP COMPLEMENT.

Type Designation	*Stock No.*	*Location*
General Elec. #313		Inside Transmitter
General Elec. #313		Inside Control Box

4. RADIO JAMMING.

Types of jamming likely to be employed by the enemy are:

a. "Spark" jamming is the familiar type of noise obtained from small electric motors, razors, ignition system, etc.


ANTENNA SHUNT CAPACITOR
CONTROL D
CONTROL C
CONTROL E
VOICE
J104
J103
J101
J102
J105
J106
J1001
J1002
J1003
J1004
J1005
J1006
J1007
J1008
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J1010
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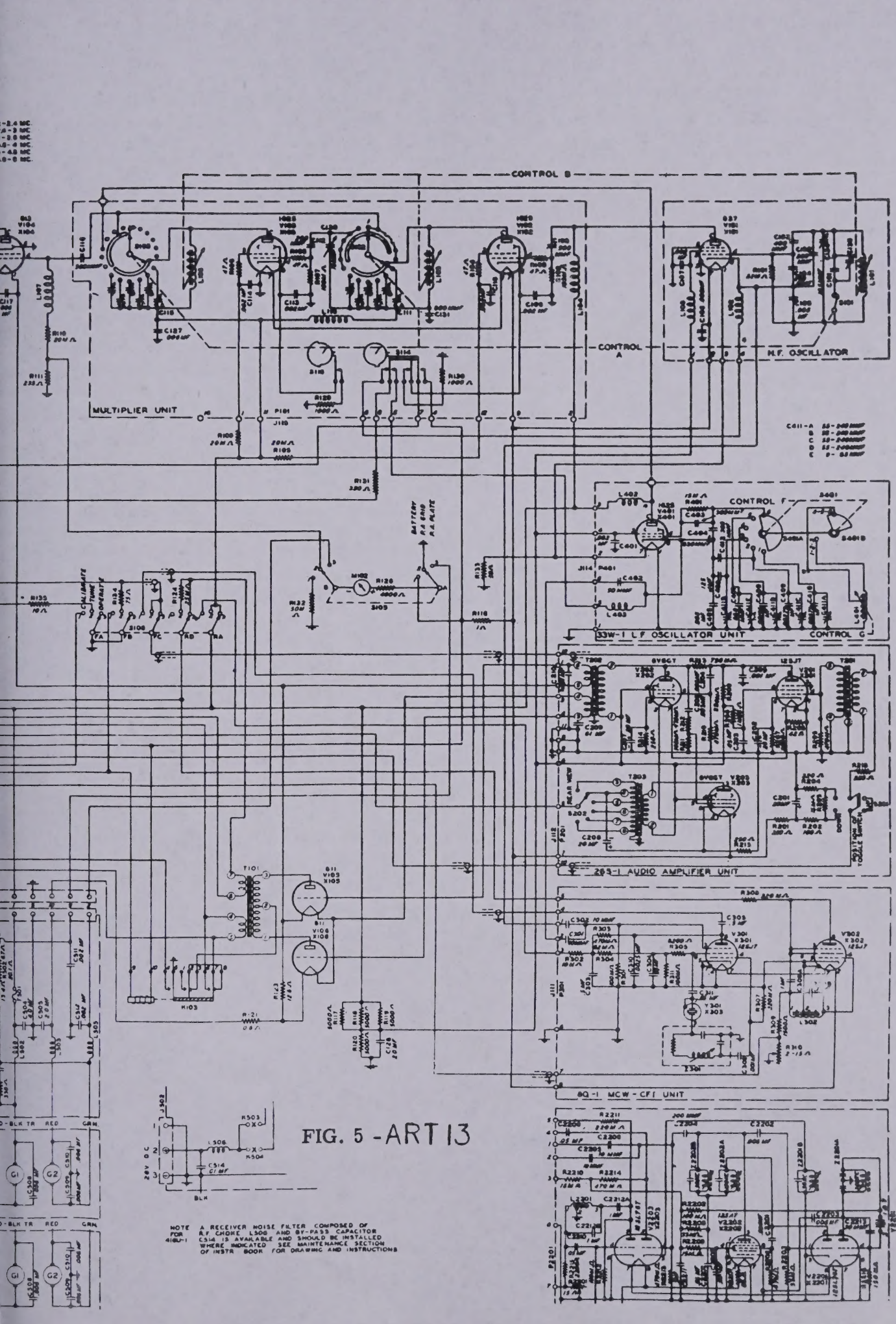

FIG. 5 - ART 13

NOTE FOR 418U-1: A RECEIVER NOISE FILTER COMPOSED OF R.F. CHOKE L306 AND BY-PASS CAPACITOR C514 IS AVAILABLE AND SHOULD BE INSTALLED WHERE INDICATED. SEE MAINTENANCE SECTION OF INSTR. BOOK FOR DRAWING AND INSTRUCTIONS